FAA-RD-76-76-III

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AIRCRAFT CONFIGURATION NOISE REDUCTION

VOLUME III
Computer Program Source Listing

D6-42849-3
June 1976

FINAL REPORT

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Springfield, Virginia 22151.

Prepared for

U.S. DEPARTMENT OF TRANSPORTATION
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NOTICE

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H. C. True, DOT/FAA Technical Monitor

16. Abstract

This report discusses use of wing and fuselage structures as noise barriers for shielding aircraft engine noise from the community. The report concerns use of favorable aircraft configurations for community noise reduction of turbojet and turbofan powered aircraft. Significant noise reduction potential is illustrated on a hypothetical engine-over-wing (EOW) configuration using high bypass ratio turbofan engines. Noise shielding estimation procedures are developed for two types of configuration noise reduction concepts; i.e., the EOW and the engine-over-fuselage (EOF).

Results are described for a theoretical analysis, a major Boeing/Aeritalia test program, and an empirical analysis of test data. As a result, analytical prediction procedures are defined, computerized, and added to the software previously developed under NASA contract NAS2-6969. The shielding prediction procedures consider individual noise components: inlet fan, compressor, exit fan, core, turbine, and jet noise. A new source, jet/edge interaction noise, can also be predicted using the procedures. The collective software, incorporating the shielding package of this report, can be used to estimate community noise levels of wing and fuselage shielded turbofan or turbojet noise.

This report is presented in three volumes. Volume I contains the engineering analysis. Volume II contains a User's Guide for computer programs and other appendices. Volume III contains the complete computer program listing.

17. Key Words		18. Distribution Statement
Noise reduction Noise suppression Wing shielding Fuselage shielding Diffraction Refraction	Scattering Community noise Fan noise Core noise Turbine noise Jet noise Jet/edge noise	Document is available to the public through the National Technical Information Service, Springfield, Virginia 22151.

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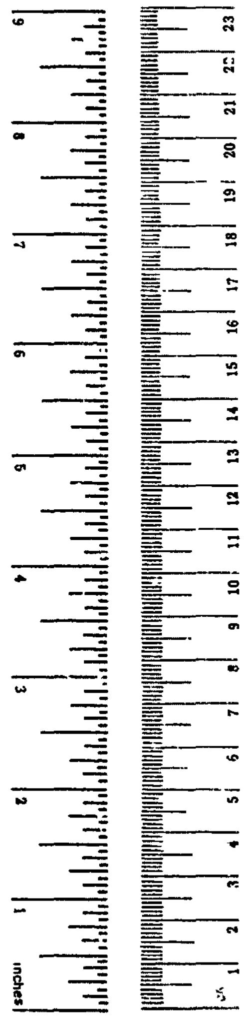
Form DOT F 1700.7 (8-69)

METRIC CONVERSION FACTORS

Approximate Conversions to Metric Measures

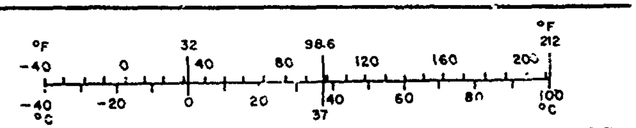
Symbol	When You Know	Multiply by	To Find	Symbol
	LENGTH			
in	inches	*2.5	centimeters	cm
ft	feet	30	centimeters	cm
yd	yards	0.9	meters	m
mi	miles	1.6	kilometers	km
	AREA			
in^2	square inches	6.5	square centimeters	cm^2
ft^2	square feet	0.09	square meters	m^2
yd^2	square yards	0.8	square meters	m^2
mi^2	square miles	2.6	square kilometers	km^2
	acres	0.4	hectares	ha
	MASS (weight)			
oz	ounces	28	grams	g
lb	pounds	0.45	kilograms	kg
	short tons (2000 lb)	0.9	tonnes	t
	VOLUME			
tsp	teaspoons	5	milliliters	ml
Tbsp	tablespoons	15	milliliters	ml
fl oz	fluid ounces	30	milliliters	ml
c	cups	0.24	liters	l
pt	pints	0.47	liters	l
qt	quarts	0.95	liters	l
gal	gallons	3.8	liters	l
ft^3	cubic feet	0.03	cubic meters	m^3
yd^3	cubic yards	0.76	cubic meters	m^3
	TEMPERATURE (exact)			
°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C

*1 in = 2.54 (exactly). For other exact conversions and more detailed tables, see NBS Misc. Publ. 286, Units of Weights and Measures, Price $2.25, SD Catalog No. C13.10:286.



Approximate Conversions from Metric Measures

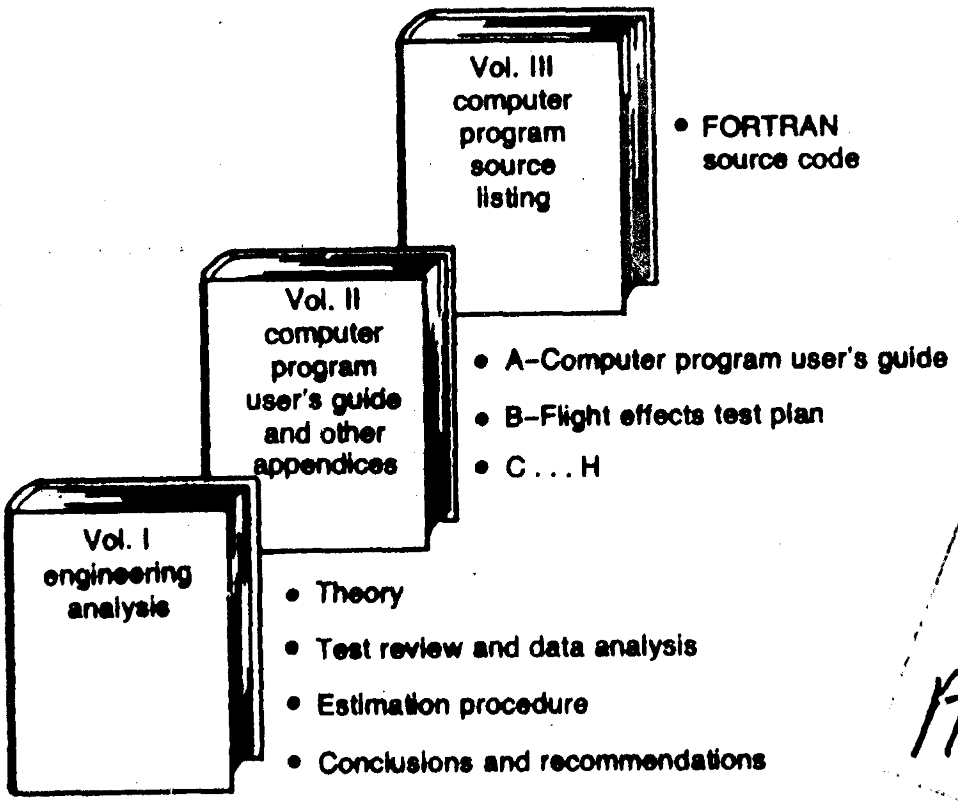
Symbol	When You Know	Multiply by	To Find	Symbol
	LENGTH			
mm	millimeters	0.04	inches	in
cm	centimeters	0.4	inches	in
m	meters	3.3	feet	ft
m	meters	1.1	yards	yd
km	kilometers	0.6	miles	mi
	AREA			
cm^2	square centimeters	0.16	square inches	in^2
m^2	square meters	1.2	square yards	yd^2
km^2	square kilometers	0.4	square miles	mi^2
ha	hectares (10,000 m^2)	2.5	acres	
	MASS (weight)			
g	grams	0.035	ounces	oz
kg	kilograms	2.2	pounds	lb
t	tonnes (1000 kg)	1.1	short tons	
	VOLUME			
ml	milliliters	0.03	fluid ounces	fl oz
l	liters	2.1	pints	pt
l	liters	1.06	quarts	qt
l	liters	0.26	gallons	gal
m^3	cubic meters	35	cubic feet	ft^3
m^3	cubic meters	1.3	cubic yards	yd^3
	TEMPERATURE (exact)			
°C	Celsius temperature	9/5 (then add 32)	Fahrenheit temperature	°F



PREFACE

This is one of three volumes of the final report on "Aircraft Configuration Noise Reduction" submitted by the Boeing Commercial Airplane Company, Seattle, Washington, 98124, in fulfillment of Department of Transportation contract DOT-FA74WA-3497, dated 1 August 1974. This work was completed for the ATC Airport Facilities section of the Federal Aviation Adminstration (DOT). Mr. H. C. True was the Contract Technical Monitor.

The report is divided into three volumes for easy use as shown below:



This report is volume III of the series and was jointly prepared by the Noise Technology Staff of the Boeing Commercial Airplane Company and the Noise Systems Group of Boeing Comptuer Services, Inc. This volume contains the source code listing of the computer programs for evaluating "Aircraft Configuration Noise Reduction" as defined in the engineering document, volume I. The User's Guide for the programs is contained in appendix A of volume II. The material presented herein is reference data for use in conjunction with the material presented in volumes I and II.

The source code presented is written in FORTRAN IV (ANSI standard) for compilation using the FTN compiler on the CDC6600 KRONOS 2.1 Operating System. The actual program was delivered to the Federal Aviation Administration (DOT) on magnetic tape. The order of the programs listed herein corresponds to that on the tape.

TABLE OF CONTENTS

*MO = Main Overlay Program
SO = Secondary Overlay Program
M = Main Program
S = Subroutine
F = Function

TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS (Concluded)

```
      OVERLAY(EXEC,0,0)
      PROGRAM TEE330A(INPUT=104B,OUTPUT=2002B,TAPE5=INPUT,TAPE6=OUTPUT,
     1               TAPE8=104B,TAPE9=104B,TAPE10=104B,TAPE11=104B,
     2               TAPE12=104B,TAPE13=104B,TAPE20=104B)
C
C     LOGICAL FILE NAMES AND THEIR USAGE
C
C     FILE  8     IS A SCRATCH OUTPUT REPORT FILE (FLIGHT PATH/OBSERVER
C                 GEOMETRY)
C
C     FILE  9     IS A SCRATCH OUTPUT REPORT FILE (NOISE EXTRAPOLATION
C                 CORRECTIONS)
C
C     FILE 10     IS A SCRATCH OUTPUT REPORT FILE (FREE-FIELD NOISE PER
C                 NOISE COMPONENT)
C
C     FILE 11     IS A SCRATCH FILE USED ONLY BY OVERLAY 5.0 (MEASURED
C                 DATA)
C
C     FILE 12     IS A SCRATCH OUTPUT REPORT FILE (OBSERVED NOISE PER
C                 COMPONENTS)
C
C     FILE 13     IS A SCRATCH DIRECT-ACCESS FILE FOR LINING
C
C     FILE 20     IS A FINAL OUTPUT FILE FOR FOLLOW ON PROGRAMS SUCH
C                 AS TEE227)
C
C     THIS PROGRAM IS THE RESULT OF PHASE B OF NASA CONTRACT NAS2-6969
C     ITS  PURPOSE IS NOISE PREDICTION FOR AIRCRAFT BASED ON THE FOLLOW
C     NOISE COMPONENTS SELECTIVELY MAKING UP VARIOUS AIRCRAFT CONFIGURAT
C
C     INPUT DATA BLOCKS FOR NOISE COMPONENTS
C     ITYPE DEFINES THE TYPE OF NOISE COMPONENT
C ITYPE=1  PRIMARY JET
C  =2      PRIMARY AND SECONDARY JET
      COMMON/JETDAT/NJET1,MCODE1,AP1,WF1,VP1,AS2,WS2,VS2,PR1,PA1,
     1    TT1,VA1,DIAMT1,ANGJT1,ICCR1
C  =3      CORE AND TURBINE
      COMMON/COREIN/TT3,PP3,CMF3,EK3,DELT3,JB3,
     *  ICOR3,LIN3,NTF3,IMA3,LGM3,NWL3,IOP3,ILAY3,TF3(10),
     *  PCTA3(10),PLA3(10),ELCH3,EDH3,RIW3(10),TL3(10),CF3,FM3
C  =4      COMPRESSOR AND INLET FAN
C  =5      EXIT FAN
      COMMON/FANDAT/NSTG45,NLET45,NAFT45,IOP45,NB45(3),FPR45(3),
     1  DIAM4(3),RSS45(3),AREA5(3),RN145,RTS4,CFPR45,DELT45,
     *  NI5,BPR5,ICOR4,LIN4,NTF4,IMA4,LGM4,NWL4,IOP4,ILAY4,TF4(10),
     *  PCTA4(10),PLA4(10),ELCH4,EDH4,RIW4(10),TL4(10),CF4,FM4,
     *  ICOR5,LIN5,NTF5,IMA5,LGM5,NWL5,ICP5,ILAY5,TF5(10),
     *  PCTA5(10),PLA5(10),ELCH5,EDH5,RIW5(10),TL5(10),CF5,FM5
C  =6      AUGMENTER-WING JET
      COMMON/SWITCH/NTYPE,ITYPE,NENG,ICCP,IPRT(7),ICN(13),NLCPT
     *,INSEOW(3),INSHLD
      COMMON/AUGWNG/GAMA6,TT6,NPR6,DELT6,AD6,CE6,
     *  ICOR6,LIN6,NTF6,IMA6,LGM6,NWL6,ICP6,ILAY6,TF6(10),
     *  PCTA6(10),PLA6(10),ELCH6,EDH6,RIW6(10),TL6(10),CF6,FM6
C  =7      BLOWN-FLAP JET
C  =8      EJECTOR - SUPPRESSOR JET
```

```
C  =9      LIFT-FAN
C  =10     PROPELLER
      COMMON/PROPIN/T10,W10,RPM10,D10,DSUB10,ASUB10,B10,DELT10,
     *ICOR10,LIN10,NTF10,IMA10,LGM10,NWL10,IDP10,ILAY10,TF10(10),
     *PCTA10(10),PLA10(10),ELCH10,EDH10,R1W10(10),TL10(10),CF10,FM10
C  =11     HELICOPTER AND TILT ROTOR
      COMMON/COPTER/T11,Q11,RPM11,311,CT11,AB11,DE11,RN11,
     1         S11,CEE11,DELT11,XLMC11,XM11,NRTR11,LLF11,
     *ICOR11,LIN11,NTF11,IMA11,LGM11,NWL11,IDP11,ILAY11,TF11(10),
     *PCTA11(10),PLA11(10),ELCH11,EDH11,R1W11(10),TL11(10),CF11,FM11
C
C     THE ITYPE FOLLOWING IS ADDED TC NAS2-6969 UNDER
C     FAA CONTRACT DOT-FA74WA-3497
C
C     ITYPE = 13  JET EDGE INTERACTION
C
      COMMON/JETEDG/AJS13,DDA13,DDNE13,DHNL13,DJCL13,
     *FLAP13,HD13,EMJ13,TSR13,ICOR13
C
C IBM360
C     THIS ROUTINE HANDLES LINKAGE TO INPUT MODULES  FLIGHT-PATH
C     OBSERVER GEOMETRY MODULE  VARICUS NCISE ESTIMATION MODULES
C     EXTRAPOLATION MODULE  HUMAN RESPCNSE MEASUREMENT MODULE
C     INTEGER XTRANSF
C
C     CONSTANTS USED IN INTERNAL CALCULATICNS
C
      COMMON /GCONST/ IN,IO,IT1,IT2,F0,F1,F2,F3,F4,F5,F6,F7,F8,F9,F10,
     *                I0,I1,I2,I3,I4,I5,I6,I7,I8,I9,I10,P1,P33,P5,P001,
     *               EPS,UNDEF,BL,ICD,DPR,RPD,ETA(17),M1,FM1,I17,A,PI
C
C     VARIABLE SET CALCULATED IN THE PRCGRAM PRCCESSING
C
      COMMON /GCOMON/ NCF,NK,BCF(24),TSPL(24,10,17),SPLT(24,17),
     *BUF(25),RETA(17),SPL2(17),TGAGR(24),DLPSF(17)
C
C     FREQUENCY BANDS USED BY PROGRAM
C
      COMMON /GFREQ/ CFREQ(24),UFREQ(25),PFREQ(24)
C
C     GENERAL INPUT PARAMETERS
C
      COMMON /GPRAM/ALTP,ALTR,SLOPE,AMACH,NCBS,SLDIST(10),NTENG,IUNIT
     *     ,ISPTRM,IATMOS,IAIR,UAIRAB(24),NTEMP,TEMP(50),TALT(50)
     *     ,NPRES,PRES(50),PALT(50),NHUMIC,RALT(50),RHUMID(50),CTEMP
     *     ,CPRES,CRHUMD,IEGA,IGDR,DTEMP,DPRES,DHUMID,XKN,ND,FLD(50),
     * ZNR(50),ZNI(50),LINECT,MAXLIN,IPAGE,BCG,TCG,FLR,AALT,EPF,ISFE
C
C
      COMMON/SUMSPL/SSPL(24,10,17)
C
C     AIRCRAFT-OBSERVER GEOMETRY CUTPUTS
C
      COMMON /GEOMO/ APY(10,17),APZ(10,17),PD(10,17),DPND(10,17),
     * B1(10,17),B2(10,17),TDS(17,10),TFD(17,10),IRR(10,17)
     *,APP,TP,PHP,APO,TC,RHC,CA,CZ,ISP(17,10),CCV
C
```

```
C     CONVERSION CONSTANTS
C
      COMMON/GCONVC/C(2,10),SLDISX(10)
      COMMON/CRSPLS/DOB(17),PSCR(17),DPB(408),NPSCR
      COMMON/ONECAL/ICALL
C
      COMMON/ICPATH/NCAS,NCOF,NTYP,IC,NRN,IARRAY(2)
      COMMON/PNLD/PSPL(17,20),EPNL(5,10),TEPNL(5,10)
      COMMON/CLABEL/CH(2,8)
C
C     THE FOLLOWING LABELED COMMON STATEMENTS ARE ADDED TO NAS2-6969
C     UNDER FAA CONTRACT DOT-FA74WA-3497
C
C     ENGINE WING GEOMETRY VARIABLES USED IN WING SHIELDING
C
      COMMON/EWGEO/SWPTE,SWLE,DIHED,DOSD,DDX1D,DDX2D,DDXOD,
     *DDY1D,DDY2D,DDYOD,DDLD,DIANI,IES
C
C     VARIABLES USED FOR NOISE COMPONENT REFRACTION AND EDGE DIFFRACTION
C
      COMMON/REFRAC/EMJ,TSTSO,IWED(3),FASS(24),BETA(24),CPSIC(24),NASRC,
     * ASF,IWSFE
      COMMON/UNSHLD/USPL(19),PSI(19),NUSPL,INUSP
C
C     VARIABLES USED IN JET NOISE SHIELDING ATTENUATION
C
      COMMON/JNSHLD/DIAMT2,DSL1,DSL2
C
C MASS STORAGE (RANDOM DISK I/O) INDECES, COUNTER, AND FLAG
      COMMON /MSIO/ INDX1(40), INDX2(3), INDX3(36), ICL, IOPEN
      DIMENSION XL(2)
      DIMENSION BUFP(33),FTKM(2,2)
      DIMENSION XNAME(7,13)
      DIMENSION ALPH(13)
      DIMENSION GRT(2),IGRD(2)
      DATA GRT/4HKMPH,4H MPH/
      DATA IGRD/16,10/
      DATA XNAME/4HPRIM,4HARY ,3HJET,4*1H ,4HPRIM,4HARY ,4HAND ,4HSECO,
     *     4HNDAR,4HY JE,1HT,4HCORE,4H/TUR,4HBINE,4*1H ,4HCOMP,4HRESS,
     *     4HOR A,4HND I,4HNLET,4H FAN,1H ,4HEXIT,4H FAN,5*1H ,4HAUGM,
     *     4HENTE,4HR-WI,4HNG J,2HET,2*1H ,4HBLOW,4HN-FL,4HAP J,2HET,
     *     3*1H ,4HLIFT,4H-FAN,5*1H ,4HEJEC,4HTOR ,4H- SU,4HPPRE,
     *     4HSSOR,4H JET,1H ,4HPROP,4HELLE,1HR,4*1H ,4HHELI,4HCOPT,2HER,
     *     4*1H ,4HMEAS,4HURED,4H DAT,1HA,3*1H ,
     *     4HJET ,4HEDGE,4H INT,4HERAC,4HTION,2*1H /
      DATA ALPH/1HA,1HB,1HC,1HD,1HE,1HF,1HG,1HH,1HI,1HJ,1HK,1HL,1HM/
      DATA PT/1H./,YES/3HYES /,YNO/2HNO/
      DATA XL/2HM.,2HFT/
      DATA FTKM/3HKM),4H1000,1H ,4H FT)/,CC/1H,/,PL/1H(/,PR/1H)/
C     SUBR. ABSORP, ANGLES, CORSPL, ERRSET
C     HAVE BEEN CALLED TO INCLUDE THEM IN THE (0,0) OVERLAY
C     ALTHO THEY ARE NOT USED IN THE (0,0) OVERLAY.
C     THEY HAVE VARIABLES IN DATA STATEMENTS THAT CHANGE
C     AFTER FIRST LOADING ,AND THESE VALUESARE
C     OVERRIDEN WITH INITIAL VALUES WHEN THE OVERLAYS ARE
C     RELOADED ,HENCE THEIR REMOVAL TO (0,0)OVERLAY
      IF(IGRD(1).EQ.IGRD(2))CALL ABSORP
```

```
      IF(IGRD(1).EQ.IGRD(2))CALL ANGLES                                 PHBNAC
      IF(IGRD(1).EQ.IGRD(2))CALL CCRSPL                                 PHBNAC
      IF(IGRD(1).EQ.IGRD(2))CALL LININS                                 PHBNAC
      IF(IGRD(1).EQ.IGRD(2))CALL ERRSET(0,0)                            PHBNAC
C     CALL TO INITIALIZING ROUTINE                                      PHBNAC
    5 CALL INITL                                                        PHBNAC
C     INPUT ALL PARAMETERS RELATED TO THE GENERAL FORMAT OF THE PROGRAM PHBNAC
C     THESE INPUTS INCLUDE THE FOLLOWING PARAMETERS IN THE GPRAM BLOCK  PHBNAC
C                                                                       PHBNAC
C         ALTP          -     ALTITUDE OF THE AIRPLANE                  PHBNAC
C         ALTR          -     ALTITUDE OF THE SIDELINE OBSERVATIONS     PHBNAC
C         SLOPE         -     CLIMB  GRADIENT (TANGENT OF THETA)        PHBNAC
C         AMACH         -     AIRCRAFT MACH NUMBER                      PHBNAC
C         NOBS          -     NUMBER OF SIDELINE OBSERVATIONS (MAX. OF 1 PHBNAC
C         SLDIST(1-10)   -     SIDELINE DISTANCES                       PHBNAC
C         NTENG         -     NUMBER OF DIFFERNT TYPES OF ENGINES (MAX.C PHBNAC
C         IUNIT     - DEFAULT =0 ALL DIMENTIONAL INPUTS AND OUTPUTS IN M PHBNAC
C                             =1 IN ENGLISH UNITS                       PHBNAC
C     READ IN GENERAL INITIALIZING DATA                                 PHBNAC
      CALL INPUTG                                                       PHBNAC
      IF  (IOD - 1)  7, 7, 5000                                         PHBNAC
 7    CONTINUE                                                          PHBNAC
C      THIS SECTION CALCULATES THE DOPLER SHIFT                         PHBNAC
C                                                                       PHBNAC
C     CONVERT $GDATA PARAMETERS TO ENGLISH UNITS FOR COMPUTATION        PHBNAC
C                                                                       PHBNAC
      IF(IUNIT.EQ.IO)CALL CONVR(20,I1,I1)                               PHBNAC
      DO 52 I=I1,I17                                                    PHBNAC
      DOPSF(I)=F1                                                       PHBNAC
      IF(IDOP.EQ.IO)GO TO 52                                            PHBNAC
 51   DOPSF(I)=F1-AMACH*COS(RETA(I))                                    PHBNAC
 52   CONTINUE                                                          PHBNAC
      NCAS=NCAS+I1                                                      PHBNAC
      DO 4    K=1,ND                                                    PHBNAC
      IF(FLD(K+25).NE.O.)FLD(K)=ALOG10(FLD(K+25))                       PHBNAC
 4    ZNI(K)=-ZNI(K+25)                                                 PHBNAC
 45   CONTINUE                                                          PHBNAC
      IF(NCAS.NE.I1)GO TO 15C                                           PHBNAC
C     DETERMINE AND STORE 1/3 OR FULL OCTAVE FREQUENCIES                PHBNAC
      IF(ISPTRM.EQ.I1)GO TO 20                                          PHBNAC
      NCF=24                                                            PHBNAC
      NK=I3                                                             PHBNAC
      DO 10 I=I1,NCF                                                    PHBNAC
      BUF(I)=UFREQ(I)                                                   PHBNAC
 10   BCF(I)=CFREQ(I)                                                   PHBNAC
      BUF(25)=UFREQ(25)                                                 PHBNAC
      GO TO 40                                                          PHBNAC
 20   NCF=I8                                                            PHBNAC
      NK=I1                                                             PHBNAC
      J=I2                                                              PHBNAC
      DO 30 I=I1,NCF                                                    PHBNAC
      BCF(I)=CFREQ(J)                                                   PHBNAC
      BUF(I)=UFREQ(J-1)                                                 PHBNAC
 30   J=J+3                                                             PHBNAC
      BUF(I9)=UFREQ(25)                                                 PHBNAC
 40   CONTINUE                                                          PHBNAC
      DO 50 I=I1,NCF                                                    PHBNAC
```

```
 50   PFREQ(I)=BCF(I)/1000.                                             PHBNAC
 150  CONTINUE                                                          PHBNAC
C     CONVERT INPUT  DATA AND CALCULATE AIRCRAT-OBSERVER GEOMETRY IF IUN PHBNAC
 200  CONTINUE                                                          PHBNAC
C     PERFORM THE GEOMETRY CALCULATIONS FOR THE CURRENT CASE            PHBNAC
      ICALL =0                                                          PHBNAC
C                                                                       PHBNAC
      CALL OVERLAY(6HEXEC10,1,0,6HRECALL)                               PHBNAC
      ICALL=1                                                           PHBNAC
C     IS TYPE 4 REPORT SPECIFIED ( FLIGHTPATH/OBSERVER GEOMETRY)        PHBNAC
      IF(IPRT(4).NE.4)GO TO 250                                         PHBNAC
C                                                                       PHBNAC
C     CONVERT $GDATA PARAMETERS TO M.K.S. UNITS FOR OUTPUT              PHBNAC
C                                                                       PHBNAC
      IF(IUNIT.EQ.IO)CALL CONVR(19,I2,I2)                               PHBNAC
 4835 CALL PRINTH(IPRT(4),LCT,8)                                        PHBNAC
      WRITE(8,4841)                                                     PHBNAC
 4841 FORMAT(37X,40HF L I G H T   P A T H   /   O B S E R V E R,        PHBNAC
     *2X,16HG E O M E T R Y )                                           PHBNAC
      WRITE(8,4842)AALT,CH(IUNIT+1,1),AMACH,SLOPE                       PHBNAC
 4842 FORMAT(//10X,16HAIRPORT ALTITUDE,9X,1H=,1X,1PE10.3,A3//           PHBNAC
     *10X,20HAIRCRAFT MACH NUMBER,5X,1H=,1X,E10.3,13X,1H,,2X,           PHBNAC
     *17HCLIMB    GRADIENT,5X,1H=,1X,E10.3,17H FOR (Z .GT. ZR)       )  PHBNAC
      WRITE(8,4843) ALTP,CH(IUNIT+1,1),ALTR,CH(IUNIT+1,1)               PHBNAC
 4843 FORMAT(10X,20HAIRCRAFT HEIGHT (Z0),5X,1H=,1X,1PE10.3,A3,2X,       PHBNAC
     *34HAT T = 0,  OBSERVER HEIGHT (ZR)  =,1X,E10.3,A3 )               PHBNAC
      WRITE(8,4845) C2,CH(IUNIT+1,8),CCV,CH(IUNIT+1,8)                  PHBNAC
 4845 FORMAT(10X,14HSPEED OF SOUND,11X,1H=,1X,1PE10.3,1X,A3,            PHBNAC
     1  10H AT (Z0) ,,                                                  PHBNAC
     *2X,14HSPEED OF SOUND,8X,1H=,1X,E10.3,1X,A3,8H AT (ZR)  )          PHBNAC
      WRITE(8,4846) CA,CH(IUNIT+1,8)                                    PHBNAC
 4846 FORMAT(10X,26HAVERAGE  SPEED OF SOUND  =,1X,1PE10.3,1X,A3,        PHBNAC
     *38H FOR SOUND  PROPAGATION OVER RANGE (P) )                       PHBNAC
 4847 FORMAT(/47X,24HSIDELINE DISTANCE (Y)  =,1X,1PE11.3,A3//12X,       PHBNAC
     *  10HTIME (SEC),                                                  PHBNAC
     *10X,5HANGLE,8X,15HA/C COORDINATES,5X,21HPROPAGATION  DP/P FOR,    PHBNAC
     *5X,30HANGLES FOR NOISE EXTRAPOLATION /9X,5HSOUND,7X,5HSOUND,8X,   PHBNAC
     *2HXI,10X,1HY,11X,1HZ,6X,10HDISTANCE P,3X,10HGRD.REFLX.,7X,6HDELTA 1 PHBNAC
     *,9X,6HBETA 2 /10X,4HREC.,7X,5HXMIT.,6X,6H(DEG.),7X,1H(,A2,1H),    PHBNAC
     *8X,1H(,A2,1H),8X,1H(,A2,1H),22X,6H(DEG.),9X,6H(DEG.)//)           PHBNAC
 4848 FORMAT(8X,F6.1,6X,F6.1,4X,F7.2,4X,1PE11.3,3(2X,E10.3),2(5X,E10.3)) PHBNAC
      LCT=14                                                            PHBNAC
      DO 4860 I=1,NOBS                                                  PHBNAC
      DO 4860 J=1,17                                                    PHBNAC
      IF(LCT.GE.54)GO TO 4851                                           PHBNAC
      IF((J.EQ.11).AND.(LCT.LE.47))GO TO 4852                           PHBNAC
      IF(J.EQ.1) GO TO 4851                                             PHBNAC
      GO TO 4853                                                        PHBNAC
 4851 CALL PRINTH(IPRT(4),LCT,8)                                        PHBNAC
      WRITE(8,4841)                                                     PHBNAC
      LCT=LCT+1                                                         PHBNAC
 4852 WRITE(8,4847)SLDISX(I),CH(IUNIT+1,1),XL(IUNIT+1),XL(IUNIT+1),     PHBNAC
     *               XL(IUNIT+1)                                        PHBNAC
      LCT=LCT+7                                                         PHBNAC
 4853 WRITE(8,4848) TPD(J,I),TDS(J,I),ETA(J),APY(I,J),APZ(I,J),PL(I,J), PHBNAC
     *               DPND(I,J),B1(I,J),B2(I,J)                          PHBNAC
      LCT=LCT+1                                                         PHBNAC
```

```
 4860 CONTINUE
C
C     CONVERT $GDATA PARAMETERS TO ENGLISH UNITS FOR COMPUTATION
C
      IF(IUNIT.EQ.IO)CALL CONVR(19,I1,I1)
 250  CONTINUE
 350  CONTINUE
      CALL OVERLAY(6HEXEC10,1,0,6HRECALL)
C      SECTION FOR SETTING UP LINKAGE TO THE VARIOUS NOISE
C      COMPONENT MODULES THAT HANDLE BOTH THE INPUT AND CALCULATIONS
      IC=I0
      DO 4000 NC=1,NTENG
      NTYP=I0
      NCOF=NC
C
C     IF SHIELDING IS REQUIESTED FOR THAT PARTICULAR
C     CONFIGURATION,READ IN ENGINE/WING GEOM DATA
C
      IF(INSEOW(NC).NE.0)CALL EWGIC
 500  CONTINUE
      IF(NTYP.GE.NTYPE)GO TO 4000
      IC=IC+I1
C
C     GET $NOISIN DATA AND CONVERT TO ENGLISH UNITS FOR COMPUTATION
C
      CALL NINPUT
C
C     PRINT OUT ENG/WING GEOMETRY IF SHIELDING SPECIFIED
C
      IF(NTYP.NE.I1)GO TO 530
      IF(INSEOW(NCOF).NE.0)CALL EWGOUT(IPRT,IUNIT)
  530 CONTINUE
C
C
C     TEST FOR JET EDGE INTERACTION NOISE COMPONENT
C
      IF(ITYPE.EQ.13) GO TO 888
C
C     IF NOISE COMPONENT JET FLOW REFRACTION EFFECTS AND SHIELDING
C     FOR THE PARTICULAR CONFIGURATION IS REQUIRED READ IN COMPONENT
C     SHIELDING DATA. A CONFLICT OCCURS WHEN SHIELDING IS REQUESTED
C     FOR THE COMPONENT AND NOT THE CONFIGURATION.
C
      IF(INSHLD.EQ.0)GO TO 888
      IF(INSEOW(NC).NE.0.AND.INSHLD.NE.0)GO TO 878
      IF(INSEOW(NC).EQ.0.AND.INSHLD.NE.0)WRITE(6,777)ITYPE
  777 FORMAT(1H0,60H    SHIELDING REQUEST CONFLICT  NO ENG/WNG GEOM
     *ITYPE=   ,I2)
C      IF PRIMARY AND SECONDARY READ SHIELDING DATA
      IF(ITYPE.LE.2)GO TO 878
      IF(ITYPE.GT.2)INSHLD=0
      GO TO 888
C
  878 CALL NSRIO
C
  888 GO TO (1100, 1100, 1200, 1100, 1100, 1200, 1500,
     *        1300, 1200, 1300, 1300, 1400, 1500), ITYPE
```

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 1100 CONTINUE
      CALL OVERLAY(6HEXEC20,2,0,6HRECALL)
      GO TO 500
 1200 CONTINUE
      CALL OVERLAY(6HEXEC30, 3, 0, 6HRECALL)
      GO TO 500
 1300 CONTINUE
      CALL OVERLAY(6HEXEC40, 4, 0, 6HRECALL)
      GO TO 500
 1400 CONTINUE
      CALL OVERLAY(6HEXEC50, 5, 0, 6HRECALL)
      GO TO 500
 1500 CONTINUE
      CALL OVERLAY(6HEXEC60, 6, 0, 6HRECALL)
      GO TO 500
 4000 CONTINUE
C
C     ENG/WIN GEOMETRY DATA IS OUTPUT ON FILE 8 FOR ALL CONFIGURATIONS
C     AFTER FLIGHT PATH/OBSERVER GEOMETRY DATA. HENCE THE FILE MARK AND
      ENDFILE 8
      REWIND 8
C
C     CONVERT ALL PARAMETERS $GDATA AND $NOISIN TO MKS UNITS FOR OUTPUT
C
      IF(IUNIT.EQ.IO)CALL CONVR(I1,I2,I3)
      DO 4600 K2=I1,NOBS
      DO 4500 K1=I1,NOF
      DO 4500 K3=I1,17
      TSPL(K1,K2,K3)=SSPL(K1,K2,K3)-TSPL(K1,K2,K3)
 4500 SPLT(K1,K3)=TSPL(K1,K2,K3)
      CALL PNLSUB(SPLT(1,1),PSPL(1,K2),TPD(1,K2),EPNL(1,K2),
     1    SPL2,IEPNL(1,K2),NK,BCG,TCG,FLR,K2,NOBS,IRR(K2,1))
C       CALL NOISO PRINT ROUTINE TO PRINT EITHER TYPE 1 OR DEFAULT
C           REPORT ON THE OUTPUT FILE
      CALL NOISO(IPRT(1),K2,NK,6,CHIN,IUNIT,SLDISX(K2),PFREQ,SPLT(1,1),
     *NOF,14)
 4600 CONTINUE
C     IS THE TYPE 2 REPORT SPECIFIED (ASSUMPTIONS ON WHICH THE PREDICTIO
C                IS BASED)
 4810 IF(IPRT(2).EQ.2)GO TO 4311
      IF(IPRT(1).NE.I6)GO TO 4767
 4311 CONTINUE
      EGP=YES
      GRD=YES
      CALL PRINTH(IPRT(2),LCT,6)
      WRITE(6,4820)
 4820 FORMAT(50X,32HASSUMPTIONS FOR NOISE PREDICTION //)
      LCT=8
      WRITE(6,4821)
 4821 FORMAT(2X,44H1) GEOMETRIC-MEAN PASSBAND FREQUENCIES (KHZ)     )
      WRITE(6,4822) (PFREQ(I),I=1,NOF)
 4822 FORMAT(6X,1PE10.3,11(E10.3)/6X,12E10.3)
      WRITE(6,4823)
 4823 FORMAT(1H )
      DO 4825 I=1,NOF
      IGAGR(I)=JAIRAB(I)
 4825 CONTINUE
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      WRITE(6,4824) (FTKM(IUNIT+1,I),I=1,2)                            PHBNAC
 4824 FORMAT(2X,44H2) ATMOSPHERIC ABSORPTION COEFFICIENTS (DB /,2A4)    PHBNAC
      WRITE(6,4826)(TGAGR(I),I=1,NCF)                                   PHBNAC
 4826 FORMAT(6X,12F10.2)                                                PHBNAC
      WRITE(6,4827)                                                     PHBNAC
 4827 FORMAT(/ 2X,25H3) ATMOSPHERIC CONDITIONS  )                       PHBNAC
      IG=IATMOS+I1                                                      PHBNAC
      GO TO(4828,4729,4731,4736,4742),IG                                PHBNAC
 4828 WRITE(6,4829)                                                     PHBNAC
 4829 FORMAT(8X,33HINTERNATIONAL STANDARD ATMOSPHERE )                  PHBNAC
      GO TO 47 50                                                       PHBNAC
 4729 WRITE(6,4730)DTEMP,CH(IUNIT+1,6),CPRES,CH(IUNIT+1,7),CHUMID       PHBNAC
 4730 FORMAT(7X,40HINTERNATIONAL STANDARD ATMOSPHERE PLUS (,F6.2,       PHBNAC
     *5H DEG ,A1,1H,,F7.2,1X,A4,1H,,F7.2,8H PCT RH) )                   PHBNAC
      GO TO 4750                                                        PHBNAC
 4731 WRITE(6,4732) CH(IUNIT+1,6),CH(IUNIT+1,1)                         PHBNAC
 4732 FORMAT(7X,31HTEMPERATURE  VS. ALTITUDE (DEG ,A1,1H,,A3,1H))       PHBNAC
      WRITE(6,4733)(PL,TEMP(I),CO,TALT(I),PR,CC,I=1,NTEMP)              PHBNAC
 4733 FORMAT(7X,A1,1PE10.3,A1,E10.3,2A1,1X,A1,E10.3,A1,E10.3,2A1,1X,A1, PHBNAC
     1 E10.3,A1,E10.3,2A1,1X,A1,E10.3,A1,E10.3,2A1,1X,A1,E10.3,A1,E10.3, PHBNAC
     2 2A1)                                                             PHBNAC
      WRITE(6,4734) CH(IUNIT+1,7),CH(IUNIT+1,1)                         PHBNAC
 4734 FORMAT(7X,27HPRESSURE     VS. ALTITUDE (,A4,1H,,A3,1H))           PHBNAC
      WRITE(6,4733)(PL,PRES(I),CC,PALT(I),PR,CC,I=1,NPRES)              PHBNAC
      WRITE(6,4735) CH(IUNIT+1,1)                                       PHBNAC
 4735 FORMAT(7X,32HREL.HUMIDITY VS. ALTITUDE (PCT ,,A3,1H))             PHBNAC
      WRITE(6,4733)(PL,RHUMID(I),CC,RALT(I),PR,CC,I=1,NHUMID)           PHBNAC
      CALL PRINTH(IPRT(2),LCT,6)                                        PHBNAC
      WRITE(6,4820)                                                     PHBNAC
      GO TO 4750                                                        PHBNAC
 4736 IF(IUNIT.EQ.1) GO TO 4738                                         PHBNAC
      CPRES=1.0                                                         PHBNAC
      CTEMP=288.16                                                      PHBNAC
      GO TO 4740                                                        PHBNAC
 4738 CPRES=14.696                                                      PHBNAC
      CTEMP=518.688                                                     PHBNAC
 4740 CRHUMD=70.0                                                       PHBNAC
 4742 WRITE(6,4737) CTEMP,CH(IUNIT+1,6),CPRES,CH(IUNIT+1,7),CRHUMD      PHBNAC
 4737 FORMAT(7X,27HHOMOGENEOUS ATMOSPHERE OF (,F6.2,5H DEG ,A1,1H,,F8.2, PHBNAC
     *1X,A4,1H,,F7.2,8H PCT RH) )                                       PHBNAC
 4750 WRITE(6,4751)                                                     PHBNAC
 4751 FORMAT(/2X,42H4) ITEMS CONSIDERED IN NOISE EXTRAPOLATION      )   PHBNAC
      WRITE(6,4752)(PT,I=1,17),(PT,I=1,16)                              PHBNAC
 4752 FORMAT(5X,26HA) SPHERICAL DIVERGENCE    ,17A1,5H  YES/5X,         PHBNAC
     * 27HB) ATMOSPHERIC ABSORPTION  ,16A1,5H  YES)                     PHBNAC
      GRP=YES                                                           PHBNAC
      IF(IEGA.NE.0)EGP=YNO                                              PHBNAC
      WRITE(6,4753)(PT,I=1,14),EGP                                      PHBNAC
 4753 FORMAT(5X,29HC) EXTRA-GROUND ATTENUATION  ,14A1,2X,A3 )           PHBNAC
      WRITE(6,4754)IGRD(IUNIT+1),GRT(IUNIT+1)                           PHBNAC
 4754 FORMAT(8X,31HSOUND PROPAGATION IS DOWNWIND (,I2,1X,A4,7H).       ) PHBNAC
      IF(IGOR.NE.0)GRP=YNO                                              PHBNAC
      WRITE(6,4755) (PT,I=1,21),GRP                                     PHBNAC
 4755 FORMAT(5X,22HD) GROUND REFLECTION  ,21A1,2X,A3)                   PHBNAC
      IF(IGOR.NE.0) GO TO 4757                                          PHBNAC
 4756 FORMAT(8X,42H3 DB ADDED TO FREE FIELD SPECTRA INSTEAD.   )        PHBNAC
      GO TO 4758                                                        PHBNAC
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 4757 WRITE(6,4756)
      GO TO 4762
 4758 WRITE(6,4759)XKN
 4759 FORMAT(8X,6HK1/KO=,1PE10.3,58H AND GROUND IMPEDANCE VS. FREQUENCY
     *IN  HZ DATA CURVES ARE      )
      WRITE(6,4760)
 4760 FORMAT(8X,23H(RE(Z1/Z0), F) DATA ... )
      WRITE(6,4733)(PL,ZNR(I),CO,FLS(I+25),PR,CO,I=1,ND)
      WRITE(6,4761)
 4761 FORMAT(8X, 23H(IM(Z1/Z0), F) DATA ... )
      WRITE(6,4733)(PL,ZNI(I)   ,CC,FLL(I+25),PR,CC,I=1,ND)
 4762 WRITE(6,4763)
 4763 FORMAT(/2X,30H5) NOISE COMPONENTS CONSIDERED,28X,12HNO. OF TIMES )
      NJ=0
      DO 4765 I=1,13
      IF(ICN(I).EQ.0)GO TO 4765
      NJ=NJ+1
      WRITE(6,4766)  ALPH(NJ),PR,(XNAME(J,I),J=1,7),ICN(I)
 4766 FORMAT(5X,2A1,1X,7A4,2X,6HMODULE,19X,I3)
 4765 CONTINUE
 4767 CONTINUE
C     IS TYPE 3 REPORT SPECIFIED (OBSERVED NOISE PER COMPONENTS)
      IF(IPRT(3).NE.3)GO TO 4840
      ENDFILE 12
      REWIND 12
 4830 READ(12,4831) BUFP
 4831 FORMAT(33A4)
      IF  (EOF(12))  4840, 4832
C360  READ(12,4831,END=4840)BUFP
 4832 WRITE(6,4831)BUFP
      GO TO 4830
 4840 IF(IPRT(4).NE.4)GO TO 4870
 4854 READ(8,4831)BUFP
      IF  (EOF(8))  4870, 4855
C360  READ(8,4831,END=4870)BUFP
 4855 WRITE(6,4831)BUFP
      GO TO 4854
C     IS TYPE 5 REPORT SPECIFIED &NOISE EXTRAPOLATION CORRECTIONS)
 4870 IF(IPRT(5).NE.5)GO TO 4880
 4874 READ(9,4831)BUFP
      IF  (EOF(9))  4880, 4875
C360  READ(9,4831,END=4880)BUFP
 4875 WRITE(6,4831)BUFP
      GO TO 4874
C     IS TYPE 6 REPORT SPECIFIED (TOTAL NOISE ALL COMPONENTS- FREE-FIELD
 4880 IF(IPRT(6).NE.6)GO TO 4890
      DO 4882 I=I1,NOBS
      DO 4881 J=I1,I17
      DO 4881 L=I1,NCF
      SPLT(L,J)=SSPL(L,I,J)
 4881 CONTINUE
      CALL NOISO(IPRT(6),1,NK,I6,CHIN,IUNIT,SLOISX(I),PFREQ,SPLT(1,1),
     *NCF,14)
 4882 CONTINUE
C     IS TYPE 7 REPORT SPECIFIED (FREE-FIELD NOISE PER NOISE COMPONENT)
 4890 IF(IPRT(7).NE.7)GO TO 4900
      ENDFILE 10
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      REWIND 10
 4894 READ(10,4831)BUFP
      IF  (EOF(10))  4900, 4895
C360  READ(10,4831,END=4870)BUFP
 4895 WRITE(6,4831)BUFP
      GO TO 4894
 4900 CONTINUE
C     TRANSFER TO PICK UP A NEW CASE
      GO TO  5
 5000 CONTINUE
      ENDFILE 20
      REWIND 20
      IF(NRN.EQ.0)STOP
C360  CALL LOGDSK
      IF  (IOPEN .NE. 0)  CALL CLOSMS(13)
      STOP
      END
```

```
      BLOCK DATA
C
C ITYPE=1  PRIMARY JET
C  =2      PRIMARY AND SECONDARY JET
      COMMON/JETDAT/NJET1,MCODE1,AP1,WP1,VP1,AS2,WS2,VS2,PR1,PA1,
     1     TT1,VA1,DIAMT1,ANGJT1,ICOR1
C
C  =3      CORE AND TURBINE
      COMMON/COREIN/TT3,PP3,CMF3,EK3,DELT3,JB3,
     *  ICOR3,LIN3,NTF3,IMA3,LGM3,NWL3,ICP3,ILAY3,TF3(10),
     *  PCTA3(10),PLA3(10),ELCH3,EDH3,R1W3(10),TL3(10),CF3,FM3
C
C
      COMMON/TURBIN/BN3,SS3,VTR3,CLS3,CT3,TU3,PMF3,CS3,IC3,ISW3
C
C  =4      COMPRESSOR AND INLET FAN
C  =5      EXIT FAN
      COMMON/FANDAT/NSTG45,NLET45,NAFT45,IDP45,NB45(3),FPR45(3),
     1  DIAM4(3),RSS45(3),AREA5(3),RN145,RTS4,CFPR45,DELT45,
     *  NI5,BPR5,ICOR4,LIN4,NTF4,IMA4,LGM4,NWL4,ICP4,ILAY4,TF4(10),
     *  PCTA4(10),PLA4(10),ELCH4,EDH4,R1W4(10),TL4(10),CF4,FM4,
     *  ICOR5,LIN5,NTF5,IMA5,LGM5,NWL5,IDP5,ILAY5,TF5(10),
     *  PCTA5(10),PLA5(10),ELCH5,EDH5,R1W5(10),TL5(10),CF5,FM5
C
C  =6      AUGMENTER-WING JET
      COMMON/AUGWNG/GAMA6,TT6,NPR6,DELT6,AD6,DE6,
     *  ICOR6,LIN6,NTF6,IMA6,LGM6,NWL6,ICP6,ILAY6,TF6(10),
     *  PCTA6(10),PLA6(10),ELCH6,EDH6,R1W6(10),TL6(10),CF6,FM6
C
C  =7      BLOWN-FLAP JET
      COMMON/BLOWIN/PR7,TT7,AN7,DN7,FANG7,DELT7,DL7,HD7,ICOR7
C
C  =8       LIFT-FAN
      COMMON/LFTFAN/NB8,FPR8,DIAM8,RSS8,AREA8,RN18,RTS8,CRFPR8,DELTA8,
     *  ICOR8,LIN8,NTF8,IMA8,LGM8,NWL8,ICP8,ILAY8,TF8(10),PCTA8(10),
     *  PLA8(10),ELCH8,EDH8,R1W8(10),TL8(10),CF8,FM8
C
C  =9      EJECTOR - SUPPRESSOR JET
      COMMON /EJECTO/ IEJECT,NUMTBS,AREA,AR,TS,AMACHJ,AMACHS,CV,
     *  PS,PAREA,PTS,PMACHJ,PCV,EJANG,
     *ICOR9,LIN9,NTF9,IMA9,LGM9,NWL9,ICP9,ILAY9,
     *TF9(10),PCTA9(10),PLA9(10),
     *ELCH9,EDH9,R1W9(10),TL9(10),CF9,FM9
C
C  =10     PROPELLER
      COMMON/PROPIN/T10,W10,RPM10,D10,DSUB10,ASUB10,B10,DELT10,
     *ICOR10
C
C  =11     HELICOPTER AND TILT ROTOR
      COMMON/COPTER/T11,Q11,RPM11,B11,CT11,AB11,DE11,RN11,
     1       S11,CEE11,DELT11,XLMC11,XM11,NRTR11,LLF11,IRR11,
     *ICOR11
C
C
C  =12     MEASURED DATA INPUTS
      COMMON/MEASIN/NEP12,NPSI12,NBTA12,DELT12,EP12(5),PSI12(17),
     *   BETA12(5),
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     *ICOR12
C
C
C     ITYPE = 13  JET EDGE INTERACTION
      COMMON/JETEDG/AJS13,DDA13,DDNE13,DHNL13,CJCL13,
     *FLAP13,HD13,EMJ13,TSR13,ICOR13
C
C
C     ENG/WING GEOMETRY AND SHIELDING DATA
      COMMON/EWGEO/SWPTE,SWLE,DIHED,DCSD,DDX1D,DDX2D,DDXOD,
     *DDY1D,DDY2D,DDYOD,DDLD,DIANI,IES
C
C
      COMMON/REFRAC/EMJ,TSTSD
C
      COMMON/UNSHLD/USPLA(19),FSI(19),NUSPL,INUSP
      COMMON/CLABEL/ CH(2,8)
C
C     CONSTANTS USED IN INTERNAL CALCULATIONS
C
      COMMON /GCONST/ IN,IO,IT1,IT2,F0,F1,F2,F3,F4,F5,F6,F7,F8,F9,F10,
     *                I0,I1,I2,I3,I4,I5,I6,I7,I8,I9,I10,P1,P33,P5,P001,
     *                EPS,UNDEF BL,ICL,DPR,RPD,ETA(17),M1,FM1,I17,A,PI
      DIMENSION CFO(11),IOC(11),CP1(4)
      EQUIVALENCE (CFO(1),F0),(IOC(1),IO),(CP1(1),P1)
C
C     VARIABLE SET CALCULATED IN THE PROGRAM PROCESSING
C
      COMMON /GCOMON/ NCF,NK,DLF(24),TSPL(24,10,17),SPLT(24,17),
     *BLF(25),RETA(17),SPL2(17),TGAGR(24),DUPSF(17)
C
C
C     FREQUENCY BANDS USED BY PROGRAM
C
      COMMON /GFREQ/ CFREQ(24),UFREQ(25),PFREQ(24)
C
C
C     GENERAL INPUT PARAMETERS
C
      COMMON /GPRAM/ALTP,ALTR,SLOPE,AMACH,NOBS,SLDIST(10),NTENG,IUNIT
     *    ,ISPTRM,IATMOS,IAIR,UAIRAB(24),NTEMP,TEMP(50),TALT(50)
     *    ,NPRES,PRES(50),PALT(50),NHUMID,RALT(50),RHUMID(50),CTEMP
     *    ,CPRES,CRHUMD,IEGA,IGDR,DTEMP,DPRES,DHUMID,XKN,ND,FLD(50),
     * ZNR(50),ZNI(50),LINECT,MAXLIN,IPAGE,BCG,TCG,FLR,AALT,EPF
C
C
C     AIRCRAFT-OBSERVER GEOMETRY OUTPUTS
C
      COMMON /GEOMO/ APY(10,17),APZ(10,17),PD(10,17),LPND(10,17),
     * B1(10,17),B2(10,17),IDS(17,10),TPD(17,10),IRR(10,17)
     *,APP,TP,RHP,APO,TC,RHC,CA,CZ,TSP(17,10),CCV
C
      COMMON/SUMSPL/SSPL(24,10,17)
C
      COMMON/ONECAL/ICALL
C
      COMMON/PNLD/PSPL(17,20),EPNL(5,10),TEPNL(5,10)
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      COMMON/TMSPL/SPZ(24,17),IB(2,3,13)
C
      COMMON/ISWK/ISWT(3,13)
      COMMON/ANGLE/PSI(17,10),PSIO(17,10),BETA(17,10)
      COMMON/HEAD/HIN(20),HOUT(20),CHIN(20)
C
C     CONVERSION CONSTANTS
C
      COMMON/GCONVC/C(2,10),SLDISX(10)
      COMMON/CRSPLC/DOB(17),PSCR(17),DPB(408),NPSCR
C       INTERNAL INDICATORS FOR DETERMINING WHERE THE INSTRUCTION
C        COUNTER IS LOCATED
      COMMON/ICPATH/NCAS,NCOF,NTYP,IC,NRN,IARRAY(2)
C             NCAS  IS THE NUMBER OF THE CURRENT CASE BEING PROCESSED
C             NCOF  IS THE NUMBER OF THE CURRENT CONFIGURATION BEING
C                    PROCESSED
C             NTYP  IS THE TOTAL NUMBER OF NOISE COMPONENTS PROCESSED
C                    FOR THE CURRENT CONFIGURATION
C
C
      COMMON/SWITCH/NTYPE,ITYPE,NENG,IDCP,IPRT(7),ICN(13),NLOPT
     *,INSEOW(3),INSHLD
C
C MASS STORAGE (RANDOM DISK I/O) INDECES, COUNTER, AND FLAG
      COMMON /MSIO/ INDX1(40), INDX2(3), INDX3(36), IC1, ICPEN
C /JETDAT/ DATA
      DATA NJET1,MCODE1,AP1,WP1,VP1,AS2,WS2,VS2,PR1,PA1,TT1,VA1,DIAMT1,
     *      ANGJT1,ICOR1 /0,1,12*0.0,0/
C /COREIN/ DATA
      DATA           TT3,PP3,CMF3,EK3,DELT3,JB3,
     *  ICOR3,LIN3,NTF3,IMA3,LGM3,NWL3,IDP3,ILAY3,TF3      ,
     *  PCTA3    ,PLA3     ,ELDH3,EDH3,R1W3     ,TL3     ,CF3,FM3
     * /5*0.0,2*0,0,3*0,2,1,10*0.0,100.,9*0.0,34*0.0/
C /TURBIN/ DATA
      DATA           BN3,SS3,VTR3,CLS3,CT3,TU3,PMF3,CS3,IC3,ISW3
     * / 8*0.0,2*0/
C /FANDAT/ DATA
      DATA           NSTG45,NLET45,NAFT45,IDP45,NB45    ,FPR45
     *  /0,0,0,0,3*0,3*0./,
     1  DIAM4    ,RSS45    ,AREA5    ,RN145,RTS4,CFPR45,DELT45
     *  /3*0.,3*0.,3*0.,0.,0.,0.,0./,
     *  NI5,BPR5,ICOR4,LIN4,NTF4,IMA4,LGM4,NWL4,ICP4,ILAY4,TF4
     */0,1.,0,0,0,0,0,0,2,1,10*0./,
     *  PCTA4    ,PLA4     ,ELCH4,EDH4,R1W4     ,TL4     ,CF4,FM4
     * /100.,9*0.,10*0.,0.,0.,10*0.,10*0.,0.,0./,
     *  ICOR5,LIN5,NTF5,IMA5,LGM5,NWL5,IDP5,ILAY5,TF5
     * /0,0,0,0,0,0,2,1,10*0./,
     *  PCTA5    ,PLA5     ,ELCH5,EDH5,R1W5     ,TL5     ,CF5,FM5
     * / 10*0.,10*0.,0.,0.,10*0.,10*0.,0.,0./
C /AUGWNG/ DATA
      DATA           GAMA6,TT6,NPR6,DELT6,AC6,DE6
     * / 1.4,0.,0,0.,0.,0./,
     *  ICOR6,LIN6,NTF6,IMA6,LGM6,NWL6,IDP6,ILAY6,TF6
     * /0,0,0,0,0,0,2,1,10*0./,
     *  PCTA6    ,PLA6     ,ELCH6,EDH6,R1W6     ,TL6     ,CF6,FM6
     * /100.,9*0.,10*0.,0.,0.,10*0.,10*0.,0.,0./
C /BLOWIN/ DATA
```

```
      DATA          PR7,TT7,AN7,DN7,FANG7,CELT7,DL7,HD7,ICCR7            BLKDATA
     * / 8*0.,0 /                                                        BLKDATA
C /LFTFAN/ DATA                                                          BLKDATA
      DATA          NB8,FPR8,DIAM8,RSS8,AREA8,RN18,RTS8,CRFPR8,DELTA8,   BLKDATA
     *  ICOR8,LIN8,NTF8,IMA8,LGM8,NWL8,IDP8,ILAY8,TF8    ,PCTA8    ,     BLKDATA
     *  PLA8    ,ELOH8,EDH8,R1W8     ,TL8     ,CF8,FM8                   BLKDATA
     *  /0,8*0.,0,5*0,2,1,10*0.,100.,9*0.,34*0./                         BLKDATA
C /EJECTD/ DATA                                                          BLKDATA
      DATA             IEJECT,NUMTBS,AREA,AR,TS,AMACHJ,AMACHS,CV,        BLKDATA
     *  PS,PAREA,PTS,PMACHJ,PCV,EJANG,                                   BLKDATA
     *ICOR9,LIN9,NTF9,IMA9,LGM9,NWL9,IDF9,ILAY9,                         BLKDATA
     *TF9     ,PCTA9     ,PLA9     ,                                     BLKDATA
     *ELOH9,EDH9,R1W9     ,TL9     ,CF9,FM9                              BLKDATA
     * /2*0,12*0.,3*0,0,2*C,2,1,10*C.,100.,9*0.,34*0./                   BLKDATA
C /PROPIN/ DATA                                                          BLKDATA
      DATA          T10,W10,RPM10,D10,CSUB10,ASUB10,B10,DELT10,          BLKDATA
     *ICOR10/8*0.0,0/                                                    BLKDATA
C /CCPTER/ DATA                                                          BLKDATA
      DATA          T11,Q11,RPM11,B11,CT11,AB11,DE11,RN11,               BLKDATA
     1        S11,CEE11,DELT11,XLMC11,XM11,NRTR11,LLF11,IRR11,           BLKDATA
     *ICOR11     / 13*0.,4*C/                                            BLKDATA
C /MEASIN/ DATA                                                          BLKDATA
      DATA          NEP12,NPSI12,NBTA12,DELT12,EP12     ,PSI12     ,     BLKDATA
     *    BETA12    ,                                                    BLKDATA
     *ICOR12          / 3*0,28*C.,0/                                     BLKDATA
C /JETEDG/ DATA                                                          BLKDATA
      DATA AJS13/5.7/,DDA13/.7854/,DDNE13/0./,CHNL13/C./,DJCL13/5./,     BLKDATA
     *FLAP13/0./,HD13/4.0/,EMJ13/0./,TSR13/1./,ICCR13/0/                 BLKDATA
C /EWGIC/ DATA                                                           BLKDATA
      DATA SWPTE,SWPLE,DIHED,DDXOD,DDYCD,DIANI,IES/                      BLKDATA
     *              0.,0.,0.,0.,.1,.3048,C/                              BLKDATA
C /REFRAC/ DATA                                                          BLKDATA
      DATA EMJ,TSTSO/0.,1./                                              BLKDATA
C /UNSHLD/ DATA                                                          BLKDATA
      DATA INUSP/0/                                                      BLKDATA
C /CLABEL/ DATA                                                          BLKDATA
      DATA CH/4H M. ,4H FT ,4H MIC,4HO PI,4HRC-N,4HCCBA,4H/SC.,4HR)  ,   BLKDATA
     *          4HM.) ,1H ,1HK,1HR,4HATM.,4HPSIA,3HM/S,3HFPS/            BLKDATA
C /GCONST/ DATA                                                          BLKDATA
      DATA UNDEF/17770CCCCCCCCCCCCCCB/                                   BLKDATA
C                                                                        BLKDATA
      DATA IN/5/,IO/6/,IT1/8/,IT2/9/,CFC/0.0,1.0,2.0,3.0,4.0,5.0,6.0,    BLKDATA
     *      7.0,8.0,9.0,1C.C/, 10C/0,1,2,3,4,5,6,7,8,9,10/,CP1/.1,       BLKDATA
     *      .33333333,.5,.CC1/,EPS/1.2E-3/,                              BLKDATA
     *      BL/4H    /,IGD/1/, DPR/57.29578/,RPD/1.745329E-2/,ETA/10.,   BLKDATA
     *      20.,30.,40.,50.,60.,70.,80.,90.,100.,110.,120.,130.,140.,    BLKDATA
     *      150.,160.,170./,M1/-1/,FM1/-1.0/,I17/17/,A/49.02142/         BLKDATA
     *,PI/3.141592653898/                                                BLKDATA
C /GCOMGN/ DATA                                                          BLKDATA
      DATA             NCF,NK,BCF     ,TSPL          ,SPLT        ,      BLKDATA
     *BUF     ,RETA     ,SPL2     ,TGAGR     ,DCPSF                      BLKDATA
     * /2*0,4595*0.,17*1.0/                                              BLKDATA
C /GFREQ/ DATA                                                           BLKDATA
      DATA CFREQ /50.11872,63.09573,79.43282,100.0000,125.8925,158.4893, BLKDATA
     *199.5262,251.1886,316.2278,398.1072,501.1872,630.9573,794.3282,    BLKDATA
     *1000.000,1258.925,1584.893,1995.262,2511.886,3162.278,3981.072,    BLKDATA
     *5011.872,6309.573,7943.282,10000.00/                               BLKDATA
```

```
      DATA UFREQ /44.66836,56.23413,70.79458,89.12509,112.2018,141.2538,
     *177.8279,223.8721,281.8383,354.8134,446.6836,562.3413,707.9458,
     *891.2509,1122.018,1412.538,1778.279,2238.721,2818.383,
     *3548.134,4466.836,5623.413,7079.458,8912.509,11220.18/
      DATA PFREQ/24*0./
C /GPRAM/ DATA
      DATA             ALTP,ALTR,SLOPE,AMACH,NCBS,SLDIST     ,NTENG,IUNIT
     *     ,ISPTRM,IATMOS,IAIR,UAIRAB      ,NTEMP,TEMP      ,TALT
     *     ,NPRES,PRES      ,PALT      ,NHUMID,RALT      ,RHUMID       ,LTEMP
     *     ,CPRES,CRHUMD,IEGA,IGDR,DTEMP,DPRES,DHUMID,XKN,NC,FLD      ,
     * ZNR      ,ZNI      ,LINECT,MAXLIN,IPAGE,BCG,TCG,FLR,AALT,EPF
     */ 4*0.,1,10*0.,1,0,3*0,24*0.,0,100*0.,0,100*0.,0,100*0.,3*0.,0,1,
     *3*0.,4.2,2,150*0.,0,56,0,10.,10.,90.,0.,0./
C /GEOMO/ DATA
      DATA             APY           ,APZ           ,PD           ,DPND          ,
     * B1           ,B2           ,TDS           ,TPD           ,IRR
     *,APP,TP,RHP,APD,TO,RHO,CA,CZ,TSP           ,COV
     * /170*0.,170*0.,170*0.,170*0.,170*0.,170*0.,170*0.,170*0.,170*0,
     * 8*0.,171*0./
C /SUMSPL/ DATA
      DATA SSPL/4080*0./
C /ONECAL/ DATA
      DATA ICALL/0/
C /PNLD/ DATA
      DATA PSPL/340*0./,EPNL/50*0./,IEPNL/50*0./
C /TMSPL/ DATA
      DATA SPZ/408*0/,IB/78*0/
C /ISWK/ DATA
      DATA ISWT/39*0/
C /ANGLE/ DATA
      DATA PSI/170*0./,PSIO/170*0./,BETA/170*0./
C /HEAD/ DATA
      DATA HIN/20*C./,HOUT/20*C./,CHIN/20*0./
C /GCONVC/ DATA
      DATA C /3.280833,.3048006,.224805,4.4483,2.204616,.4535937,
     * 1.341011,.7457061,1.8,.5555555,14.696,6.804573E-2,8*0./
C /CRSPLS/ DATA
      DATA COB/17*0./,PSCR/17*0./,DPB/408*0./,NPSCR/0/
C /ICPATH/ DATA
      DATA NCAS, NCOF, NTYP, IC, NRN, IARRAY /0,1,3*0,1,-13/
C /SWITCH/ DATA
      DATA NTYPE/1/,ITYPE/0/,NENG/1/,ICOP/0/,IPRT/7*0/,ICN/13*0/,
     *NLOPT/0/,INSEOW/3*0/,INSHLD/0/
C /MSIO/ DATA
      DATA INDX1 /40*0/, INDX2 /3*0/, INDX3 /36*0/, IC1 /0/, IOPEN /0/
      END
```

```
      OVERLAY(EXEC10,1,0)
      PROGRAM ONE
      COMMON/ONECAL/ICALL
      IF(ICALL.EQ.0)GO TO 10
      CALL NEXTCR
      RETURN
10    CALL FLTGEO(IECE)
      IF(IECE.NE.0)CALL ERROR(13,7,15)
      RETURN
      END
```

```
      OVERLAY(EXEC20,2,0)
      PROGRAM TWO
      COMMON/SWITCH/NTYPE,ITYPE
      IF  ((ITYPE .EQ. 1) .OR. (ITYPE .EQ. 2))  GO TO 12
      IF  (ITYPE .EQ. 4)  GO TO 4
      IF  (ITYPE .EQ. 5)  GO TO 5
      GO TO 100
   12 CALL JET
      GO TO 100
    4 CALL INLET
      GO TO 100
    5 CALL AFT
  100 CONTINUE
      RETURN
      END
```

```
      OVERLAY(EXEC30,3,0)
      PROGRAM THREE
      COMMON/SWITCH/NTYPE,ITYPE
      IF  (ITYPE .EQ. 3)  GO TO 3
      IF  (ITYPE .EQ. 6)  GO TO 6
      IF  (ITYPE .EQ. 9)  GO TO 9
      GO TO 100
    3 CALL COREN
      GO TO 100
    6 CALL SPECAN
      GO TO 100
    9 CALL EJECT
  100 CONTINUE
      RETURN
      END
```

```
      OVERLAY(EXEC40,4,0)
      PROGRAM FOUR
      COMMON/SWITCH/NTYPE,ITYPE
      IF  (ITYPE .EQ. 8)  GO TO 8
      IF  (ITYPE .EQ. 10)  GO TO 10
      IF  (ITYPE .EQ. 11)  GO TO 11
      GO TO 100
    8 CALL LIFTFN
      GO TO 100
   10 CALL PROP
      GO TO 100
   11 CALL COPTR
  100 CONTINUE
      RETURN
      END
```

```
OVERLAY(EXEC50,5,0)                                FIVE
PROGRAM FIVE                                       FIVE
COMMON/SWITCH/NTYPE,ITYPE                          FIVE
IF(ITYPE.EQ.12)CALL MEASRD                         FIVE
RETURN                                             FIVE
END                                                FIVE
```

```
      OVERLAY(EXEC60,6,0)
      PROGRAM SIX
      COMMON /SWITCH/ NTYPE, ITYPE
      IF  (ITYPE .EQ. 7)  GO TO 7
      IF  (ITYPE .EQ. 13)  GO TO 13
      GO TO 100
    7 CALL BLWFLP
      GO TO 100
   13 CALL JEINT
  100 CONTINUE
      RETURN
      END
```

```
      PROGRAM DATGEN(OUTPUT=2002B,TAPE6=OUTPUT,TAPE20=104B,TAPE21=104B,  DATGEN
     1              TAPE22=104B)                                         DATGEN
C     THIS PROGRAM GENERATES A SUBROUTINE FOR THE FOOTPRINT              DATGEN
C     PROGRAM WITH THE NOISE DATA FROM TEE187C STORED IN A DATA          DATGEN
C     STATEMENT, THE SIZE AND NAME OF WHICH IS PASSED TO THE             DATGEN
C     FTPRT   ROUTINE AS ARGUMENTS -E.G.  CALL FTPRT( N,DATN)            DATGEN
      DIMENSION  DI(216),X(18)                                           DATGEN
      DATA IT/0/                                                         DATGEN
      DATA KF/22/                                                        DATGEN
      DATA KI,KO,KB/20,21,0/                                             DATGEN
      DATA IC,IS,IE,IG/0,0,0,1/                                          DATGEN
      DATA A/1HA/                                                        DATGEN
      REWIND KI                                                          DATGEN
      REWIND KF                                                          DATGEN
      REWIND KO                                                          DATGEN
      N1=0                                                               DATGEN
      WRITE (6,103)                                                      DATGEN
103   FORMAT(44H  IS        IE        J1        N1        IC        IW        )  DATGEN
C     READ DATA FROM  OUTPUT FROM TEE187C (TAPE 20) AND WRITE THIS DATA  DATGEN
C     OUT ON TAPE 21  AS DATA STATEMENTS                                 DATGEN
C     IC IS THE COUNT OF THE NUMBER OF DATAARRAYS                        DATGEN
C     IS IS EQUAL TO 1 AT START OF EACHARRAY                             DATGEN
C     IE IS EQUAL TO THE LAST ELEMENT OF EACH ARRAY                      DATGEN
C     IG INDICATES THE END OF THE INPUT FILE                             DATGEN
      DO 1000 I=1,20000,216                                              DATGEN
      J1=0                                                               DATGEN
      IC=IC+1                                                            DATGEN
      IS=I                                                               DATGEN
      IE=IS+215                                                          DATGEN
 25   I1=I+J1                                                            DATGEN
      I2=I1+11                                                           DATGEN
C360  READ(KI,100,END=40)(DI(J),J=I1,I2)                                  DATGEN
      READ(KI,100) (DI(J),J=I1,I2)                                       DATGEN
      IF  (EOF(KI))  40, 20                                              DATGEN
  100 FORMAT (12A4)                                                      DATGEN
 20   J1=J1+12                                                           DATGEN
      IF(J1.EQ.216)GO TO 60                                              DATGEN
      GO TO 25                                                           DATGEN
 40   IE=J1+IS-1                                                         DATGEN
      IW=1                                                               DATGEN
      WRITE (6,102) IS, IE, J1, N1, IC, IW                               DATGEN
102   FORMAT(6I8)                                                        DATGEN
      IF(IS.GT.IE)GO TO 1050                                             DATGEN
      IG=2                                                               DATGEN
 60   CALL WRDATA(DI,1,J1,KO,IT)                                         DATGEN
      IF  (IG - 1)  1000, 1000, 1100                                     DATGEN
 1000 CONTINUE                                                           DATGEN
      IW=2                                                               DATGEN
      WRITE (6,102) IS, IE, J1, N1, IC, IW                               DATGEN
 1050 IC=IC-1                                                            DATGEN
      IW=3                                                               DATGEN
      WRITE (6,102) IS, IE, J1, N1, IC, IW                               DATGEN
      J1=216                                                             DATGEN
 1100 CONTINUE                                                           DATGEN
      IW=4                                                               DATGEN
      WRITE (6,102) IS, IE, J1, N1, IC, IW                               DATGEN
      REWIND KO                                                          DATGEN
```

```
C WRITE PROGRAM HEADER FOR MAIN PROGRAM OF FOOT PRINT
      WRITE(KF,241)
  241 FORMAT(6X,28HSUBROUTINE TEE227(INCDE,NLN)    )
      WRITE(KF,300)
 300  FORMAT(52HC      PROGRAM TEE227A(INPUT,OUTPUT,TAPE5=INPUT,TAPE6,
     X 8H=OUTPUT))
C     WRITE A COMMENT OF EXPLAINATION
      WRITE(KF,400)
 400  FORMAT(52HC      THIS PROGRAM HAS BEEN GENERATED AS A MEANS OF    /
     X60HC       CIRCUMVENTING THE NEED FOR INPUT TO TEE227 WHICH IS TO  /
     X       52HC    BE RUN UNDER CONTROL OF A REAL TIME SIMULATOR ON    /
     X60HC       THE SIGMA 7.                                            /
     X60HC       THE 4 NUMBERS REPRESENTED ON EACH LINE OF THE DATA      /
     X62HC       STATEMENT ARE THE OUTPUT OF NOISE LEVEL, ENGINE PRESSURE/
     X60HC       RATIO, ELEVATION ANGLE, LOG10 OF RANGE, GENERATED BY    /
     X60HC       THE NOISE PREDICTION PROGRAM, TEE187 PER INPUT CASE     /
     X60HC       AND PLACED ON FILE TAPE20, WHICH HAVE BEEN PROCESSED    /
     X60HC       BY THE TEE187C POST-PROCESSOR.  THE POST-PROCESSOR      /
     X60HC       INCORPORATES THIS DATA DURING THE GENERATION OF THE     /
     X60HC       MAIN PROGRAM OF TEE227, THE NOISE CONTOUR PROGRAM       /
     X62HC       WHICH THE POST-PROCESSOR HAS OUTPUT IN SOURCE CODING ON /
     X60HC       FILE TAPE22                                             )
      WRITE(KF,242)
  242 FORMAT(6X,23HCOMMON/COUNT/NEPR,    NL )
      WRITE(KF,243)
  243 FORMAT(6X,38HCOMMON/CONTNT/AEPR(6),ALRO(9),AALFA(6)      )
      N1=72
C     WRITE DIMENSION STATEMENTS FOR DATA ARRAYS
      IDI=-71
      DO 1200 I=1,IC
      IW=5
      WRITE (6,102) IS, IE, J1, N1, IC, IW
      ID=I+9
      IF(I.EQ.IC.AND.IE.EQ.0)GO TO 1300
      IF(I.EQ.IC)N1=J1/3
      IW=6
      WRITE (6,102) IS, IE, J1, N1, IC, IW
      WRITE(KF,700)A,ID,N1
 700  FORMAT(6X,10HDIMENSION ,A1,I2,1H(,I2,1H))
      IDI=IDI+72
      WRITE(KF,800)IDI,ID
 800  FORMAT(6X,18HEQUIVALENCE (DATN(,I4,3H),A,I2,4H(1)))
 1200 CONTINUE
 1300 CONTINUE
      N=72*(IC-1)+N1
      N4=N/4
      WRITE(KF,750)N
 750  FORMAT(6X,15HDIMENSION DATN(,I4,1H))
      WRITE(KF,850)N4,N4,N4,N4
 850  FORMAT(6X,13HDIMENSION D1(,I3,2H),,3HD2(,I3,2H),,3HD3(,I3,
     X2H),,3HD4(,I3,1H))
      DO 950 I=1,IT
      READ(KO,900)X
 900  FORMAT(18A4)
      WRITE(KF,900)X
 950  CONTINUE
C     WRITE CALL TO FOOT PRINT SUBROUTINE AND STOP/END
```

```
      WRITE(KF,500)N,N4                                                  DATGEN   116
  500 FORMAT(6X,2HN=,I4/6X,3HN4=,I4)                                     DATGEN   117
      WRITE(KF,550)                                                      DATGEN   118
  550 FORMAT(6X,45HCALL FTPRT(N,DATA,N4,D1,D2,D3,D4,IMODE,NLN)     ,     DATGEN   119
     X/6X,6HRETURN/6X,3HEND)                                             DATGEN   120
      REWIND KF                                                          DATGEN   121
      STOP                                                               DATGEN   122
      END                                                                DATGEN   123
```

```
      SUBROUTINE WRDATA(X,IS,IE,KC,IT)                                  WRDATA
C      X IS THE DATA ARRAY CONTAINING THE VAKUES TC BE WRITTEN OUT      WRDATA
C     IS IS THE STARTING ELEMENT CF THE ARRAY                           WRDATA
C     IE IS THE END ELEMENT  OF THE ARRAY                               WRDATA
C      KO IS THE OUTPUT FILE WHICH THE DATA STATEMENT IS WRITTEM ON     WRDATA
      DIMENSION X(1),Y(3,4),XM(2),XMX(2)                                WRDATA
      DATA XM,XMX,DAT,C,BL,SL,A,NA,N/1H ,1H ,1H ,2H X,4HDATA,1H,,1H ,   WRDATA
     X     1H/,1HA,9,0/                                                 WRDATA
      NA=NA+1                                                           WRDATA
      WRITE(KO,8001)XM,DAT,BL,A,NA,BL,SL                                WRDATA
 8001 FORMAT(A4,A2,A4,A1,A1,I2,A1,A1)                                   WRDATA
      IT=IT+1                                                           WRDATA
C     WRITE UP TO 18 CONTINUATION CARDS                                 WRDATA
      JK=-14                                                            WRDATA
      DO 1000 I=1,18                                                    WRDATA
      JK=JK+12                                                          WRDATA
      J=JK                                                              WRDATA
      DO 100 K=1,4                                                      WRDATA
      K1=K                                                              WRDATA
      J=J+3                                                             WRDATA
      Y(1,K1)=X(J)                                                      WRDATA
      Y(2,K1)=X(J+1)                                                    WRDATA
  100 Y(3,K1)=X(J+2)                                                    WRDATA
      CH=C                                                              WRDATA
      IF(IE.EQ.J+2)CH=SL                                                WRDATA
      WRITE(KO,8003)XMX,(BL,(Y(I1,I2),I1=1,3),C,I2=1,3),BL,(Y(I1,4),    WRDATA
     X I1=1,3),CH                                                       WRDATA
      IT=IT+1                                                           WRDATA
 8003 FORMAT(A4,A2,4(A1,3A4,A1))                                        WRDATA
      IF(CH.EQ.SL)GO TO 1100                                            WRDATA
 1000 CONTINUE                                                          WRDATA
 1100 CONTINUE                                                          WRDATA
      RETURN                                                            WRDATA
      END                                                               WRDATA
```

```
      PROGRAM TEX227(INPUT=104B,OUTPUT=2002B,TAPE5=INPUT,TAPE6=OUTPUT,   TEX227
     1              TAPE2=104B,TAPE99=2002B)                              TEX227
      READ(5,9000)IPLOT                                                   TEX227
 9000 FORMAT(I3)                                                          TEX227
      IF(IPLOT.NE.-1)GO TO  1000                                          TEX227
C  THIS IS AN OPTION TO PLOT WITH THE EXISTING TAPE 2                     TEX227
C  THE ENTRY INTO DRIVER BY THIS METHOD GIVES IMODE                       TEX227
C      A VALUE  FOR TESTING  THA T IT COULDNOT NORMALLY HAVE IN DRIVER    TEX227
C      THIS ALLOWS A TEST FOR  A PLOT OPTION                              TEX227
C                                                                         TEX227
      CALL DRIVES(D,D,D,D,D,D,D,D,-1)                                     TEX227
      GO TO  1010                                                         TEX227
 1000 CALL TEE227(1,0)                                                    TEX227
 1010 STOP                                                                TEX227
      END                                                                 TEX227
```

```
      INTEGER FUNCTION SEARCH(Z,X,ND,M,IS)
C     SC0931   SEARCH    PS-471    WILINSKI,R.M.    690304 6600
C                              BINARY SEARCH
C
      DIMENSION X(2)
C     FUNCTION TO HALVE INDEX DURING BINARY SEARCH
      IHALF(I) = (I + 1)/2
C
      N = IABS(M)
      SEARCH = 1
      I = 1
      IF(N .LE. 1)GO TO 24
C     INPUT PARAMETER ND MAY BE CHANGED BECAUSE DEG. IS TOO LARGE
      ND = MINO(ND,N-1)
      IF(M .GE. 0)GO TO 445
C     TEST TO PREVENT EXTRAPOLATION WHEN N IS NEGATIVE
      IF(ABS(Z+Z-X(1)-X(N)) .LE. ABS(X(1)-X(N)))GO TO 445
      IF(ABS(Z -X(1)) .GE. ABS(Z - X(N)))I = N
      GO TO 24
  445 IGO = 1
      IF(X(1) .GT. X(2))IGO = 0
C     DESCENDING X ARRAY
C     BINARY SEARCH TO BRACKET Z BETWEEN X(I) AND X(I+1)
      I = IHALF(N)
      IDLT = I
C     MAIN SEARCH LOOP
    5 IDLT = IHALF(IDLT)
      DIF = X(I) - Z
      IF(IGO .EQ. 0)DIF = -DIF
      IF(DIF)30,24,20
C     X(I) IS EXACT VALUE
   24 IS = I
      GO TO 52
C     I TOO LARGE (UNLESS I = 1)
   20 IF(I - 1)40,40,21
   21 IF(I - IDLT)22,22,23
C     IDLT TOO LARGE (BECAUSE N NOT POWER OF 2)
   22 IDLT = IHALF(IDLT)
   23 I = I - IDLT
      I=MAX0(I,1)
      GO TO 5
C     I OK OR TOO SMALL (UNLESS I = N)
   30 IF(I - N)31,40,40
C     Z NOT OUTSIDE RIGHT END OF TABLE
   31 DIF = X(I+1) - Z
      IF(IGO .EQ. 0)DIF = -DIF
      IF(DIF)34,36,40
C     X(I+1) IS EXACT VALUE
   36 IS = I + 1
      GO TO 52
C     I TOO SMALL
   34 I = I + IDLT
      IF(I - N)5,5,35
C     IDLT WAS TOO LARGE (BECAUSE N NOT POWER OF 2)
   35 I = I - IDLT
      IDLT = IHALF(IDLT)
      GO TO 34
```

```
C     Z BRACKETED BY X(I), X(I+1)
   40 IF(ND)44,44,43
C     ND .LE. 0 - - RETURN NEAREST POINT IN TABLE
   44 IF(I .EQ. N)GO TO 24
      IF(ABS(Z - X(I)) .LE. ABS(Z - X(I+1)))GO TO 24
      GO TO 36
C     FIND ND + 1 POINTS CENTERED (IF POSSIBLE) AROUND Z
   43 I = MINO(MAXO(1, I - (ND - 1)/2), N - ND)
      IS = I
      SEARCH = 0
   52 RETURN
      END
```

```
      SUBROUTINE ABSORP(RH, T, NBW, NFB, BCF, ALPHA)                  ABSORP
C     PROGRAM TO COMPUTE ABSORPTION COEFFICIENTS AS DEFINED BY        ABSORP
C     SAE-ARP866. THE (RMS) ERROR IN COMPUTING THE COEFFICIENTS IS LESS ABSORP
C     THAN 0.1 DB/1000FT.                                             ABSORP
C                                                                     ABSORP
C AUTHOR           D. G. DUNN                                         ABSORP
C                                                                     ABSORP
C                                                                     ABSORP
C                                                                     ABSORP
C     INPUTS ARE-                                                     ABSORP
C            RH = RELATIVE HUMIDITY IN PERCENT.                       ABSORP
C            NBW = BANDWIDTH INDICATOR (NBW = 1 FOR FULL OCTAVE-BANDS, ABSORP
C                                      (NBW = 3 FOR THIRD OCTAVE-BANDS) ABSORP
C            NFB = NUMBER OF FREQUENCY BANDS.                         ABSORP
C            BCF = THE ARRAY OF BAND CENTER FREQUENCIES.              ABSORP
C            T = AMBIENT TEMPERATURE IN DEGREES FARENHEIT             ABSORP
C                                                                     ABSORP
C     OUTPUT IS THE ARRAY OF ABSORPTION COEFFICIENTS (ALPHA)          ABSORP
C                                                                     ABSORP
C     RESTRICTIONS                                                    ABSORP
C                                                                     ABSORP
C            APPLICABLE ONLY TO                                       ABSORP
C             1) STANDARD COMMERCIAL OCTAVES                          ABSORP
C             2) STANDARD PREFERRED OCTAVES                           ABSORP
C             3) STANDARD PREFERRED (1/3) OCTAVES                     ABSORP
C            AND NOT APPLICABLE TO GENERALIZED FREQUENCY BANDS, I.E.  ABSORP
C             1) OCTAVES OR (.3)TH DECADE BANDS NOT DEFINED FOR (BCF) ABSORP
C                CONTAINED IN OPEN SET (4000,6788) HZ                 ABSORP
C             2) (1/3) OCTAVES OR (.1)TH DECADE BANDS NOT DEFINED FOR ABSORP
C                (BCF) CONTAINED IN OPEN SET (4000,5000) HZ           ABSORP
C                                                                     ABSORP
C     ALLOCATE STORAGE FOR OTHER ARRAYS                               ABSORP
      DIMENSION ALPHA(1), BCF(1)                                      ABSORP
      DIMENSION DX1(11), DY1(11), DX2(21), DY2(21), XD(33), YD(33)    ABSORP
C     DEFINE CONSTANTS                                                ABSORP
      DIMENSION XYD9(66),DXY19(22),DXY29(42)                          ABSORP
      DATA  XYD9                    / 0., 0., 0.25, 0.313, 0.5, 0.704, ABSORP
     10.75, 0.957, 1.0, 1.0, 1.25, 0.87, 1.5, 0.75, 1.75, 0.65, 2.0,0.57 ABSORP
     2, 2.25, 0.506, 2.5, 0.45, 2.75, 0.408, 3.0, 0.37, 3.25, 0.337,  ABSORP
     3 3.5, 0.308, 3.75, 0.286, 4.0, 0.269, 4.25, 0.253, 4.5, 0.241,  ABSORP
     4 4.75, 0.232, 5.0, 0.225, 5.25, 0.22, 5.5, 0.214, 5.75, 0.21,   ABSORP
     5 6.0, 0.205, 6.25, 0.201, 6.5, 0.2, 0.125,0.148, 0.375,0.506,   ABSORP
     6 0.625,0.874, 0.875,0.992, 1.125,0.95, 1.375,0.803 /            ABSORP
      DATA  DXY19                   /  0.0,-2.457, 10.,-2.3889,       ABSORP
     1 20.,-2.3236, 30.,-2.2708, 40.,-2.2165, 50.,-2.1748, 60.,-2.1247, ABSORP
     2 70.,-2.0825, 80.,-2.032, 90.,-1.9824, 100.,-1.9046 /           ABSORP
      DATA DXY29                    / 0.0,-1.9482, 5.,-1.8426,        ABSORP
     1 10.,-1.739, 15.0,-1.6356, 20.,-1.5411, 25.,-1.4393, 30.,-1.341, ABSORP
     2 35.,-1.2562, 40.,-1.1716, 45.,-1.088, 50.,-1.0098, 55.,-0.9391, ABSORP
     3 60.,-0.8725, 65.,-0.7949, 70.,-0.7264, 75.,-0.6541, 80., -0.5812, ABSORP
     4 85.,-0.5214, 90.,-0.4575, 95.,-0.389, 100.,-0.3298 /           ABSORP
      DATA ISET9/1/                                                   ABSORP
      IF  (ISET9 - 1)  19, 19, 29                                     ABSORP
19    ISET9=2                                                         ABSORP
      I=0                                                             ABSORP
      DO 21 K=1,66,2                                                  ABSORP
      I=I+1                                                           ABSORP
```

```
      XD(I)=XYD9(K)
21    YD(I)=XYD9(K+1)
      I=0
      DO 23 K=1,22,2
      I=I+1
      DX1(I)=DXY19(K)
   23 DY1(I)=DXY19(K+1)
      I=0
      DO 25 K=1,42,2
      I=I+1
      DX2(I)=DXY29(K)
25    DY2(I)=DXY29(K+1)
29    CONTINUE
      G1  =  TBLU1(T, DX1, DY1, 3, 11)
      G2  =  TBLU1(T, DX2, DY2, 3, 21)
      HA  =  (RH**.9881) * (10.**G2)
      SA1  =  (T + 459.688)**0.678674
      IF  (NBW - 1)  2, 1, 3
    1 DLF  =  .1290682
      FO  =  5198.5
      GO TO 4
    2 WRITE (6,11) NBW
    3 DLF  =  .05
      FO  =  4466.8
    4 DO  9  I = 1,NFB
      ALPHA(I)  =  0.0
      IF  (BCF(I))  5, 9, 5
    5 F  =  ABS(BCF(I))
      X  =  ALOG10(F)
      IF  (F .GT. FO)  X = X - DLF
      A1  =  SA1 * (10.**(2.045 * X - 5.38939))
      HMOMAX  =  10.**(.49658 * X - 1.48974)
      AMOMAX  =  10.**(.997 * X + G1)
      XX  =  HA / HMOMAX
      IF  (XX - 6.4)  6, 7, 7
    6 AMOL  =  TBLU1(XX, XD, YD, 3, 33)
      GO TO 8
    7 AMOL  =  .2
    8 AMOL  =  AMOL * AMOMAX
      ALPHA(I)  =  A1 + AMOL
    9 CONTINUE
C
      RETURN
   11 FORMAT(//2X60HTROUBLE IN SUBROUTINE ABSORP, NO STANDARDS D  INED F
     *OR NBW =,I3/2X37HTHIRD OCTAVE-BAND TYPE NOISE ASSUMED./)
      END
```

```
      SUBROUTINE AFT
C AUTHOR              D. F. MELDRUM
C
C PURPOSE             TO PREDICT AFT FAN NOISE FOR THE PHASE B
C                     NASA-AMES FOOTPRINT CONTRACT NAS2-6969.
C
C METHOD              AS DESCRIBED IN REFERENCE 1).
C
C INPUTS              VIA LABLED COMMON FANDAT
C
C                     NUMSTG    NUMBER OF FAN STAGES
C                               1 & NUMSTG & 3
C                     NINLET    SWITCH FOR INLET FAN NOISE
C                               PREDICTION IF POSITIVE.
C                     NAFT      SWITCH FOR AFT FAN NOISE
C                               PREDICTION IF POSITIVE.
C                     IDOPP     SWITCH FOR THE DOPPLAR SHIFT
C                               FLIGHT EFFECTS.
C                               0  NO FLIGHT EFFECTS OR DOPPLAR SHIFT.
C                               1  DOPPLAR SHIFT FOR THE FREQUENCY
C                                  CORRECTION ONLY.
C                               2  DOPPLAR SHIFT FOR THE FREQUENCY
C                                  AND LEVEL CORRECTION.
C                     NB(I)     NUMBER OF FAN BLADES FOR EACH STAGE
C                               WHERE 1 & I & NUMSTG
C                     FPR(I)    FAN PRESSURE RATIO
C                     DIAM(I)   FAN INLET DIAMETER (INLET ONLY)  FT
C                     RSS(I)    MINIMUM ROTOR/STATOR SPACING     PERCENT
C                     AREA(I)   FAN DISCHARGE AREA (AFT ONLY)    FT*FT
C                     RN1       ROTOR SPEED                      RPM
C                     RTS       RELATIVE TIP MACH NUMBER OF THE
C                               FIRST STAGE WITHOUT INLET GUIDE
C                               VANES (IGV).  IF LESS THAN 1
C                               IGV WILL BE ASSUMED FOR THE FIRST
C                               STAGE (INLET FAN ONLY).
C                     CRTFPR    FAN PRESSURE RATIO FOR THE
C                               RELATIVE TIP MACH NUMBER OF
C                               1.025 (INLET FAN ONLY)
C                     ANGFAN    ENGINE INCLINATION ANGLE
C
C                     VIA LABLED COMMON SWITCH
C
C                     NUMENG    NUMBER OF NOISE SOURCES OF THE SAME
C                               NOISE TYPE.
C
C                     VIA LABLED COMMON COMMON
C
C                     NOF       1/3 OCTAVE OF FULL OCTAVE SWITCH
C                               OR NUMBER OF FREQUENCY BANDS (8 OR 24)
C                     RETA(24)  DIRECTIVITY ANGLES
C
C                     VIA LABLED COMMON GPRAM
C
C                     AMACH     MACH NUMBER OF THE AIRCRAFT
C                     NOBS      NUMBER OF OBSERVER POSITIONS
C
C                     VIA LABLED COMMON SUMSPL
```

```
C
C                       SSPL       CURRENT TOTAL PREDICTED NOISE FOR NOF
C                                  (8 OR 24) FREQUENCIES, AT NOBS OBSERVER
C                                  POSITIONS FOR 17 DIRECTIVITY ANGLES.
C
C                       VIA LABLED COMMON ANGLE (SET UP BY SUBROUTINE ANGLES
C
C                       PSI        17 DIRECTIVITY ANGLES FOR EACH OF
C                                  NOBS OBSERVER POSITIONS.
C                       PSIO       17 DIRECTIVITY ANGLE PROJECTIONS FOR
C                                  EACH OF NOBS OBSERVER POSITIONS
C                       BETA       ELEVATION ANGLE PROJECTION FOR EACH
C                                  OF NOBS OBSERVER POSITIONS.
C
C                       EACH COMPONENT IS WRITTEN ON TAPE OR FILE 10
C                       FOR EACH OF NOF BANDS FOR EACH OF NOBS OBSERVER
C                       POSITIONS.
C
C OUTPUTS               VIA LABLED COMMON SUMSPL
C
C                       SSPL       CURRENT TOTAL PREDICTED NOISE FOR
C                                  8 OR 24 FREQUENCIES, AT NOBS OBSERVER
C                                  POSITIONS FOR 17 DIRECTIVITY ANGLES.
C
C                       VIA LABLED COMMON ANGLE (SET UP BY SUBROUTINE ANGLES
C
C                       PSI        17 DIRECTIVITY ANGLES FOR EACH OF
C                                  NOBS OBSERVER POSITIONS.
C                       PSIO       17 DIRECTIVITY ANGLE PROJECTIONS FOR
C                                  EACH OF NOBS OBSERVER POSITIONS
C                       BETA       ELEVATION ANGLE PROJECTION FOR EACH
C                                  OF NOBS OBSERVER POSITIONS.
C
C
C REFERENCES            1)  R. J. SAXBY,  NASA-AMES FOOTPRINT CONTRACT
C                           NAS2-6969  FAN NOISE MODULE,   UN-NUMBERED
C                           COORDINATION SHEET,  DATED 19 JANUARY 1973.
C
C FUNCTION SUBPRGM      COS        ESHLDG     PWRSUM
C
C SUBROUTINES           ANGLES     UNIT       FANNOS     ZERO
C                       WSHOUT     SHLDSP
C
C
C
C
      COMMON /FANDAT/ NUMSTG,NINLET,NAFT,ICOPP,NB(3),FPR(3),
     *                 DIAM(3),RSS(3),AREA(3),RN1,RTS,CRTFPR,ANGFAN,
     *NI5,BPR5,ICOR4,LIN4,NTF4,IMA4,LGM4,NWL4,IDP4,ILAY4,TF4(10),
     *PCTA4(10),PLA4(10),ELOH4,EDH4,R1W4(10),TL4(10),CF4,FM4,
     *ICOR5,LIN5,NTF5,IMA5,LGM5,NWL5,IDP5,ILAY5,TF5(10),
     *PCTA5(10),PLA5(10),ELOH5,EDH5,R1W5(10),TL5(10),CF5,FM5
C
      COMMON/SWITCH/NTYPE,ITYPE,NENG,IOCF,IPRT(7),ICN(13),NLOPT
     *,INSEOW(3),INSHLD
C     CONSTANTS USED IN INTERNAL CALCULATIONS
C
      COMMON /GCONST/ IN,IO,IT1,IT2,F0,F1,F2,F3,F4,F5,F6,F7,F8,F9,F10,
```

```
     *                  I0,I1,I2,I3,I4,I5,I6,I7,I8,I9,I10,P1,P33,P5,POO1,
     *                  EPS,UNDEF,BL,ICD,DPR,RPD,ETA(17),M1,FM1,I17,A,PI
C
C     VARIABLE SET CALCULATED IN THE PROGRAM PROCESSING
C
      COMMON /GCOMCN/ NCF,NK,BCF(24),TSPL(24,10,17),SPL1(24,17),
     *BUF(25),RETA(17),SPL2(17),IGAGR(24),DOPSF(17)
      COMMCN/SUMSPL/SSPL(24,10,17)
      COMMON/PNLD/PSPL(17,20),EPNL(5,10),TEPNL(5,10)
C
C     FREQUENCY BANDS USED BY PROGRAM
C
      COMMON /GFREQ/ CFREQ(24),UFREQ(25),PFREQ(24)
C
C     GENERAL INPUT PARAMETERS
      COMMON/ANGLE/PSI(17,10),PSIO(17,10),BETA(17,10)
C
      COMMON /GPRAM/ALTP,ALTR,SLOPE,AMACH,NOBS,SLDIST(10),ITENG,IUNIT
     *    ,ISPTRM,IATMOS,IAIR,UAIRAB(24),NTEMP,TEMP(50),TALT(50)
     *    ,NPRES,PRES(50),PALT(50),NHUMID,RALT(50),RHUMID(50),CTEMP
     *    ,CPRES,CRHUMD,IEGA,IGDR,DTEMP,DPRES,DHUMID,XKN,ND,FLD(50),
     * ZNR(50),ZNI(50),LINECT,MAXLIN,IPAGE,BCG,TCG,FLR,AALT,BPF
C
C     AIRCRAFT-OBSERVER GEOMETRY OUTPUTS
C
      COMMON /GEOMO/ APY(10,17),APZ(10,17),PD(10,17),DPND(10,17),
     * B1(10,17),B2(10,17),TDS(17,10),TFD(17,10),IRR(10,17)
     *,APP,TP,RHP,APO,TO,RHO,CA,CZ,ISP(17,10),CCV
C
C     CONVERSION CONSTANTS
C
      COMMON/GCCNVC/C(2,10),SLDISX(10)
      COMMON/TMSPL/SPZ(24,17),IB(2,3,13)
      COMMON/CRSPLS/DOB(17),PSCR(17),DPB(408),NPSCR
      COMMON/HEAD/HIN(20),HOUT(20),CHIN(20)
C     SHIELDING DATA. REQUIRED FOR PRINT OUT
      COMMON/UNSHLD/USPLA(19),FSI(19),NUSPL,INUSP
C
C
C
      ICN(5)=ICN(5)+1
C
C
      DELTA=ANGFAN*RPD
      CALL ANGLES(NOBS,DELTA)
C
C
C     LOOP FOR THE NUMBER OF OBSERVER POSITIONS
C
      FBPF  =  FLOAT(NB(1)) * RN1 / 60.
C
C     TEST FOR SHIELDING AND EXIT TO PRINT OUT WING
C     SHIELDING DATA ONCE FOR ALL SIDELINE POSITIONS
      IF(INSHLD.NE.0)CALL WSHOUT(IPRT(7),10,ITYPE,USPLA,NUSPL,FSI,INUSP)
   40 DO 1000 M=1,NOBS
      CALL LINCOR(SPZ(1,1),IMA5,LGM5,ELCH5,EDH5,NWL5,R1W5,TL5,
     *ILAY5,FM5,IDP5,PSI(1,M),NCF,BCF,PIA5,CF5,PCTA5,NTF5,
```

```
     *TF5,DOPSF,SPL2,ILCR5,IB(1,1,ITYPE),LIN5,FBPF)
C
      CALL ZERO(SPLT,408)
C
C
C
C     CALCULATE THE AFT FAN NOISE PREDICTION
C
      CALL FANNOS(DOPSF, PSI(1,M),SPLT(1,1),IDCP,NUMSTG,0,1,NB,FPR,
     *             DIAM,RSS,AREA,RN1,RTS,CRTFPR,0.0,BPR5,NI5)
C
C
   45 CONTINUE
C
C     CONVERT TO A UNIT OR INDEXED SPECTRA
C
      CALL UNIT(150.,17,SPLT(1,1))
      ENG=NENG
      IF(ENG.LE.0.0) ENG=1.0
      DO 50 J=1,17
      DANGLE=PSIO(J,M)
      ELVANG=BETA(J,M)
      ENS=ESHLDG(DANGLE,ELVANG,ENG)
      DO 50 K=1,24
   50 SPLT(K,J)=SPLT(K,J)-ENS
      IF(NCF.EQ.24) GO TO 300
C
C     CONVERT 1/3 OCTAVE TO FULL OCTAVE
C
      DO 200 J=1,17
      DO 200 K=1,8
      TMP  =  0.0
      DO 100 L=1,3
      JC  =  3*K + L - 3
  100 TMP  =  PWRSUM(TMP, SPLT(JC,J))
  200 SPLT(K,J)  =  TMP
C
C
C     ADD TO CURRENT TOTAL AND WRITE ON TAPE 10
C
C
  300 DO 400 J=1,NCF
      DO 400 K=1,17
  400 SPLT(J,K)=SPLT(J,K)-SPZ(J,K)
C
      IF(INSHLD.NE.0)CALL SHLDSP(AMACH,ALTR,ISFTRM,CZ,SLDIST,M,
     *APY,APZ,DOPSF,SPLT,NCF,BCF,SPZ,PSI,ITYPE,ANGFAN,XX)
C
      DO 405 J=1,NCF
      DO 405 K=1,17
  405 SSPL(J,M,K)=PWRSUM(SSPL(J,M,K),SPLT(J,K))
      IF(IPRT(7).NE.7)GO TO 410
      CALL NOISO(IPRT(7),M,NK,10,CHIN,IUNIT,SLDISX(M),PFREQ,SPLT(1,1),
     *  NCF,ITYPE)
  410 CONTINUE
      DO 360 JC=1,NCF
      DO 360 KC=1,17
```

```
 360  SPLT(JC,KC)=SPLT(JC,KC)-TSPL(JC,M,KC)
      CALL PNLSUB(SPLT(1,1),PSPL(1,M),TPD(1,M),EPNL(1,M),SPL2,
     *TEPNL(1,M),NK,BCG,TCG,FLR,M,NCBS,IRR(M,1))
      IF(IPRT(3).NE.3)GO TO 1000
      CALL NOISO(IPRT(3),M,NK,12,CHIN,IUNIT,SLDISX(M),PFREQ,
     *   SPLT(1,1),NCF,ITYPE)
C
C
C
 1000 CONTINUE
      RETURN
      END
```

```
      SUBROUTINE ANGLES(NOB,DELTA)
C
C     GENERAL INPUT PARAMETERS
C
      COMMON /GPRAM/ALTP,ALTR,SLOPE,AMACH,NCBS,X(10),NTENG,IUNIT
     *     ,ISPTRM,IATMOS,IAIR,LAIRAB(24),NTEMP,TEMP(50),TALT(50)
     *     ,NPRES,PRES(50),PALT(50),NHUMID,RALT(50),RHUMID(50),CTEMP
     *     ,CPRES,CRHUMD,IEGA,IGDR,DTEMP,DPRES,DHUMID,XKN,ND,FLD(50),
     * ZNR(50),ZNI(50),LINECT,MAXLIN,IPAGE,BCG,TCG,FLR,AALT,EPF
C
C     AIRCRAFT-OBSERVER GEOMETRY OUTPUTS
C
      COMMON /GEOMO/ Y(10,17),Z(10,17),P(10,17),DPNC(10,17),
     * B1(10,17),B2(10,17),TDS(17,10),TPC(17,10),IRR(10,17)
     *,APP,TP,RHP,APO,TO,RHO,CA,CZ,TSF(17,10),COV
C
C
C
      COMMON/ANGLE/ PSI(17,10),PSIO(17,10),BETA(17,10)
      COMMON/SDELT/DT
C
      COMMON/SWITCH/NTYPE,ITYPE,NENG,ICOP,IPRT(7),ICN(13),NLOPT
C
C
      COMMON/ICPATH/NCAS,NCOF,NTYP,IC,NRN,IARRAY(2)
C
      DATA IGO/1/
      IF(NTYP.NE.1)GO TO 2
      IGO=1
      IF(ITYPE.EQ.11)IGO=2
      GO TO 10
 2    CONTINUE
      IF(ITYPE.NE.11)GO TO 4
      IGO=2
      GO TO 8
    4 IF  (IGO - 1)  8, 8, 5
 5    IGO=1
      GO TO 10
 8    CONTINUE
      IF(DT.EQ.DELTA) GO TO 2000
 10   DT=DELTA
 30   CSDE=COS(DELTA)
      SNDE=SIN(DELTA)
      DO 100 I=1,NOB
      DO 100 J=1,17
      TEMP1=-(Y(I,J)*CSDE+ (Z(I,J)-ALTR)*SNDE)/ABS(P(I,J))
      IF(TEMP1.GT.1.1.OR.TEMP1.LT.-1.1) GO TO 1000
      IF(TEMP1.GT.1.0) TEMP1=1.0
      IF(TEMP1.LT.-1.0) TEMP1=-1.0
      PSI(J,I)=ACOS(TEMP1)*57.296
      XTNA=-(Y(I,J)*CSDE+(Z(I,J)-ALTR)*SNDE)
      IF(XTNA.NE.0.)GO TO 50
      PSIO(J,I)=0.
      GO TO 60
 50   CONTINUE
      PSIO(J,I)=ATAN2(ABS(X(I)),XTNA)
     *    *57.296
```

```
60    CONTINUE                                                        ANGLES
      ATEM=ABS(Y(I,J)*SNDE-(Z(I,J)-ALTR)*CSDE)                        ANGLES
      IF(X(I).GT.0.)GO TO 90                                          ANGLES
      BETA(J,I)=90.                                                   ANGLES
      IF(ATEM.GT.0.)GO TO 100                                         ANGLES
      BETA(J,I)=0.                                                    ANGLES
      GO TO 100                                                       ANGLES
90    CONTINUE                                                        ANGLES
      BETA(J,I)=ATAN2(ATEM,ABS                                        ANGLES
     *    (X(I)))*57.296                                              ANGLES
100   CONTINUE                                                        ANGLES
      GO TO 2000                                                      ANGLES
1000  WRITE(6,1500)                                                   ANGLES
1500  FORMAT(40H THE ARCCOS FOR PSI IS OUT OF RANGE                  )ANGLES
      STOP                                                            ANGLES
2000  RETURN                                                          ANGLES
      END                                                             ANGLES
```

```
      SUBROUTINE ATMOSP(HGT,PRESUR,TEMPER,RELHUM)                         ATMOSP
      COMMON/SWITCH/NTYPE,ITYPE,NENG,IDCP,IPRT(7),ICN(13),NLOPT           ATMOSP
C                                                                         ATMOSP
C AUTHOR             G. A. WEST                                           ATMOSP
C                                                                         ATMOSP
C PURPOSE            TO DETERMINE THE PRESSURE, TEMPERATURE AND RELATIVE  ATMOSP
C                    HUMIDITY AT A GIVEN ALTITUDE USING EITHER U.S.       ATMOSP
C                    STANDARD ATMOSPHERIC CONDITIONS OR USER DEFINED      ATMOSP
C                    ATMOSPHERE.                                          ATMOSP
C                                                                         ATMOSP
C DESCRIPTION OF VARIABLES                                                ATMOSP
C                                                                         ATMOSP
C     VARIABLES IN COMMON - SEE MAIN PROGRAM                              ATMOSP
C                                                                         ATMOSP
C     VARIABLES IN CALLING SEQUENCE                                       ATMOSP
C                                                                         ATMOSP
C       INPUT                                                             ATMOSP
C                                                                         ATMOSP
C          HGT       - ALTITUDE                                           ATMOSP
C                                                                         ATMOSP
C       OUTPUT                                                            ATMOSP
C                                                                         ATMOSP
C          PRESUR    - ATMOSPHERIC PRESSURE                               ATMOSP
C          TEMPER    - TEMPERATURE                                        ATMOSP
C          RELHUM    - PERCENT RELATIVE HUMIDITY                          ATMOSP
C                                                                         ATMOSP
C     LOCAL VARIABLES                                                     ATMOSP
C                                                                         ATMOSP
C          DUM       - WORKING STORAGE FOR SORTING ROUTINE                ATMOSP
C          K         - WORKING STORAGE FOR SORTING ROUTINE                ATMOSP
C          NSHUMD    - NUMBER OF ENTRIES IN ISA RELATIVE HUMIDITY TABLE   ATMOSP
C          NSPRES    - NUMBER OF ENTRIES IN ISA PRESSURE TABLE            ATMOSP
C          NSTEMP    - NUMBER OF ENTRIES IN ISA TEMPERATURE TABLE         ATMOSP
C          SAVNAM    - CONTAINS THE NAME OF THE CALLING ROUTINE           ATMOSP
C          SNAME     - CONTAINS THE NAME OF THIS ROUTINE                  ATMOSP
C          SPALT     - TABLE OF ALTITUDES FOR ISA PRESSURES DEFINED IN    ATMOSP
C                      ARRAY SPRES                                        ATMOSP
C          SPRES     - TABLE OF PRESSURES FOR ALTITUDES DEFINED IN        ATMOSP
C                      ARRAY SPALT                                        ATMOSP
C          SRALT     - TABLE OF ALTITUDES FOR ISA RELATIVE HUMIDITIES     ATMOSP
C                    DEFINED IN ARRAY SRHUMD                              ATMOSP
C          SRHUMD    - TABLE OF RELATIVE HUMIDITIES FOR ALTITUDES DEFINED ATMOSP
C                      ARRAY SRALT                                        ATMOSP
C          STALT     - TABLE OF ALTITUDES FOR ISA TEMPERATURES DEFINED IN ATMOSP
C                      ARRAY STEMP                                        ATMOSP
C          STEMP     - TABLE OF TEMPERATURES FOR ALTITUDES DEFINED IN     ATMOSP
C                      ARRAY STALT                                        ATMOSP
C                                                                         ATMOSP
C                                                                         ATMOSP
C                                                                         ATMOSP
C                                                                         ATMOSP
C                                                                         ATMOSP
C     GENERAL INPUT PARAMETERS                                            ATMOSP
C                                                                         ATMOSP
      COMMON /GPRAM/ALTP,ALTR,SLOPE,AMACH,NOBS,SLDIST(10),ITENG,IUNIT     ATMOSP
     *     ,ISPTRM,IATMOS,IAIR,LAIRAB(24),NTEMP,TEMP(50),TALT(50)         ATMOSP
     *     ,NPRES,PRES(50),PALT(50),NHUMID,RALT(50),RHUMID(50),CTEMP      ATMOSP
```

```
     *    ,CPRES,CRHUMD,IEGA,IGDR,DTEMP,DPRES,DHUMID,XKN,ND,FLD(50),
     * ZNR(50),ZNI(50),LINECT,MAXLIN,IPAGE,BCG,TCG,FLR,AALT,EPF
C
C
C  *  *  *  *  *  *  *   STANDARD ATMOSPHERIC TABLES  *  *  *  *  *  *  *
C
      DIMENSION STALT(50),STEMP(50),SPALT(50),SPRES(50),SRALT(50),
     1          SRHUMD(50)
      DATA NSTEMP,NSPRES,NSHUMD/21,21,7/
      DATA STALT/    0.0, 2000.0, 4000.0, 6000.0, 8000.0,10000.0,
     1           12000.0,14000.0,16000.0,18000.0,20000.0,22000.0,
     2           24000.0,26000.0,28000.0,30000.0,32000.0,34000.0,
     3           36000.0,38000.0,40000.0,29*0.0/
      DATA STEMP/518.688,507.99,504.43,497.30,490.17,483.04,
     1            475.92,468.80,461.67,454.55,447.43,440.32,
     2            433.20,426.08,418.97,411.86,404.75,397.64,
     3            390.53,389.99,389.99,29*0.0/
      DATA SPALT/    0.0, 2000.0, 4000.0, 6000.0, 8000.0,10000.0,
     1           12000.0,14000.0,16000.0,18000.0,20000.0,22000.0,
     2           24000.0,26000.0,28000.0,30000.0,32000.0,34000.0,
     3           36000.0,38000.0,40000.0,29*0.0/
      DATA SPRES/14.696,13.664,12.692,11.778,10.917,10.108,9.3486,
     1           8.6361,7.9688,7.3438,6.7588,6.2124,5.7025,5.2272,
     2           4.7844,4.3726,3.9901,3.6352,3.3064,3.0044,2.7300,
     3           29*0.0/
      DATA SRALT/    0.0, 6561.6,13123.2,19684.8,26246.4,32808.0,
     1            39369.6,43*0.0/
      DATA SRHUMD/70.0,57.0,44.0,38.0,34.0,23.0,13.0,43*0.0/
C
C                                           HAS USER DEFINED HIS OWN
C                                            ATMOSPHERIC CONDITIONS
      IF (IATMOS .EQ. 2) GO TO 10
      IF (IATMOS .EQ. 3) GO TO 20
      IF (IATMOS .EQ. 4) GO TO 30
C                                           USE U.S. STANDARD CONDITIONS
C                                            OBTAIN STANDARD PRESSURE
    5 PRESUR = TBLU1(HGT,SPALT,SPRES,1,NSPRES)
C                                            OBTAIN STANDARD TEMPERATURE
      TEMPER = TBLU1(HGT,STALT,STEMP,1,NSTEMP)
C                                            OBTAIN STANDARD RELATIVE
C                                             HUMIDITY
      RELHUM = TBLU1(HGT,SRALT,SRHUMD,2,NSHUMD)
C                                           DOES USER WISH TO ADD CONSTANT
C                                            GRADIENTS TO U.S. STANDARD
C                                            CONDITIONS
      IF (IATMOS .EQ. 0) GO TO 40
C
      PRESUR = PRESUR + DPRES
      TEMPER = TEMPER + DTEMP
      RELHUM = RELHUM + DHUMID
      GO TO 40
C                                           ATMOSPHERIC CONDITIONS DEFINED
C                                            BY USER
C
C                                           IS NPRES WITHIN RANGE
   10 IF (NPRES .LE. 50) GO TO 11
      CALL ERROR(ITYPE,1,1)
```

```
      GO TO 16                                                          ATMOSP
   11 IF (NPRES .GE. 2) GO TO 12                                        ATMOSP
      CALL ERROR(ITYPE,1,2)                                             ATMOSP
      GO TO 16                                                          ATMOSP
C                                       SORT PRESSURES TO INSURE THAT   ATMOSP
C                                        THEY ARE IN ASCENDING ORDER    ATMOSP
C                                        OF ALTITUDE                    ATMOSP
12    CALL SORTX(PALT,PRES,NPRES)                                       ATMOSP
C                                       OBTAIN PRESSURE                 ATMOSP
      PRESUR = TBLU1(HGT,PALT,PRES,1,NPRES)                             ATMOSP
C                                       IS NTEMP WITHIN RANGE           ATMOSP
      IF (NTEMP .LE. 50) GO TO 13                                       ATMOSP
      CALL ERROR(ITYPE,1,3)                                             ATMOSP
      GO TO 16                                                          ATMOSP
   13 IF (NTEMP .GE. 2) GO TO 14                                        ATMOSP
      CALL ERROR(ITYPE,1,4)                                             ATMOSP
      GO TO 16                                                          ATMOSP
C                                       SORT TEMPERATURES TO INSURE THAT ATMOSP
C                                        THEY ARE IN ASCENDING ORDER OF ATMOSP
C                                        ALTITUDE                       ATMOSP
14    CALL SORTX(TALT,TEMP,NTEMP)                                       ATMOSP
C                                       OBTAIN TEMPERATURE              ATMOSP
      TEMPER = TBLU1(HGT,TALT,TEMP,1,NTEMP)                             ATMOSP
C                                       IS NHUMID WITHIN RANGE          ATMOSP
      IF (NHUMID .LE. 50) GO TO 15                                      ATMOSP
      CALL ERROR(ITYPE,1,5)                                             ATMOSP
      GO TO 16                                                          ATMOSP
   15 IF (NHUMID .GE. 2) GO TO 17                                       ATMOSP
      CALL ERROR(ITYPE,1,6)                                             ATMOSP
   16 IATMOS = 0                                                        ATMOSP
      GO TO 5                                                           ATMOSP
C                                       SORT RELATIVE HUMIDITITES TO    ATMOSP
C                                        INSURE THAT THEY ARE IN        ATMOSP
C                                        ASCENDING ORDER OF ALTITUDE    ATMOSP
17    CALL SORTX(RALT,RHUMID,NHUMID)                                    ATMOSP
C                                       OBTAIN RELATIVE HUMIDITY        ATMOSP
      RELHUM = TBLU1(HGT,RALT,RHUMID,1,NHUMID)                          ATMOSP
      GO TO 40                                                          ATMOSP
C                                                                       ATMOSP
C                                       USE STANDARD DAY CONDITIONS FOR ATMOSP
C                                        HOMOGENEOUS ATMOSPHERE AS      ATMOSP
C                                        DEFINED BY FEDERAL AVIATION    ATMOSP
C                                        REGULATION                     ATMOSP
   20 PRESUR = 14.696                                                   ATMOSP
      TEMPER = 518.688                                                  ATMOSP
      RELHUM = 70.0                                                     ATMOSP
      GO TO 40                                                          ATMOSP
C                                       USE HOMOGENEOUS ATMOSPHERE      ATMOSP
C                                        AS DEFINED BY USER             ATMOSP
   30 PRESUR = CPRES                                                    ATMOSP
      TEMPER = CTEMP                                                    ATMOSP
      RELHUM = CRHUMD                                                   ATMOSP
C                                                                       ATMOSP
40    CONTINUE                                                          ATMOSP
      RETURN                                                            ATMOSP
      END                                                               ATMOSP
```

```
      SUBROUTINE AVGALF(Z1,ZN,NBW,NFB,BCF,ALFA,IATMCS)
C
C PURPOSE           TO CALCULATE THE AVERAGE AIR ABSORPTION COEFFICIENT
C
C AUTHOR            D. G. DUNN
C
C
      DIMENSION BCF(1),ALFA(1)
      DIMENSION SUM(31)
      DATA TO/459.688/
      DATA SNAME/8HAVGALF  /
C
      DZ = ZN - Z1
      CALL ATMOSP(Z1,DUM,T1,RH1)
      T1 = T1 - TO
      CALL ABSORP(RH1,T1,NBW,NFB,BCF,ALFA)
C                                       TEST FOR HOMOGENEOUS ATMOSPHERE
      IF (IATMCS .GE. 3) GO TO 6
      IF (DZ) 2, 6, 2
    2 CALL ATMOSP(ZN,DUM,TN,RHN)
      TN = TN - TO
      CALL ABSORP(RHN,TN,NBW,NFB,BCF,SUM)
      N = 0.5 * AMAX1(ABS(TN-T1) + ABS(RHN-RH1),20.0)
      M = N-1
      FM = M
      DZ = DZ/FM
      DO 3 J=1,NFB
      SUM(J) = 0.5 * (SUM(J) + ALFA(J))
    3 CONTINUE
      DO 4 I=2,M
      Z = Z1 + DZ * FLOAT(I-1)
      CALL ATMOSP(Z,DUM,T,RH)
      T = T - TO
      CALL ABSORP(RH,T,NBW,NFB,BCF,ALFA)
      DO 4 J=1,NFB
      SUM(J) = SUM(J) + ALFA(J)
    4 CONTINUE
      DO 5 I=1,NFB
      ALFA(I) = SUM(I)/FM
    5 CONTINUE
6     CONTINUE
      RETURN
      END
```

```
      SUBROUTINE BESJ(X, N, BJ, D, IER)
C
C  PURPOSE-
C     COMPUTE THE J BESSEL FUNCTION FOR A GIVEN ARGUMENT AND ORDER.
C
C  USAGE-
C     CALL BESJ(X, N, BJ, D, IER)
C
C  DESCRIPTION OF PARAMETERS-
C     X  -THE ARGUMENT OF THE J BESSEL FUNCTION DESIRED
C     N  -THE ORDER OF THE J BESSEL FUNCTION DESIRED
C     BJ -THE RESULTANT J BESSEL FUNCTION
C     D  -THE REQUIRED ACCURACY- SOME FRACTION OF THE J BESSEL FUNCTION
C     IER-RESULTANT ERROR CODE WHERE
C        IER = 0 ... NO ERROR
C        IER = 1 ... REQUIRED ACCURACY NOT OBTAINED
C        IER = 2 ... RANGE OF N COMPARED TO X NOT CORRECT (SEE REMARKS)
C
C  REMARKS-
C     MAGNITUDE OF (N) MUST BE LESS THAN
C        20 + ABS(X) * (10 - ABS(X) / 3) ... FOR ABS(X) .LE. 15
C        90 + ABS(X) / 2                 ... FOR ABS(X) .GT. 15
C
C  SUBPROGRAMS REQUIRED-
C     NONE
C
C  METHOD-
C     RECURRENCE RELATION TECHNIQUE DESCRIBED BY H. GOLDSTEIN AND
C     R.M. THALER,/RECURRENCE TECHNIQUES FOR THE CALCULATION OF
C     BESSEL FUNCTIONS/, M.T.A.C.,V13,PP 102-108 AND I.A. STEGUN
C     AND M. ABRAMOWITZ,/GENERATION OF BESSEL FUNCTIONS ON HIGH
C     SPEED COMPUTERS/, M.T.A.C.,V11,1957,PP 255-257.
C
C  REFERENCE-
C     THE FORTRAN PROGRAM WAS TAKEN FROM ...
C     IBM,/SYSTEM 360 SCIENTIFIC SUBROUTINE PACKAGE (360A-CM-03X)
C     VERSION III PROGRAMMERS MANUAL/,IBM APPLICATION PROGRAM H20-0205-3
C
C..............................................................
C
      IER  =  0
      BJ  =  0.
      XT  =  X
      X  =  ABS(XT)
      NT  =  N
      N  =  IABS(NT)
      IS  =  MOD(N, 2)
      SS  =  1.
      IF  (XT)  20, 10, 30
   10 IF  (NT)  210, 15, 210
   15 BJ  =  SS
      GO TO 210
   20 IF  (IS)  25, 31, 25
   25 SS  =  -SS
      GO TO 31
   30 IF  (NT)  20, 31, 31
   31 IF  (X - 15.)  32, 32, 34
```

```
   32 NTEST  =  20. + X * (10. - .3333333 * X)
      GO TO 36
   34 NTEST  =  90. + .5 * X
   36 IF  (N - NTEST)  40, 38, 38
   38 IER  =  2
      GO TO 210
   40 N1  =  N + 1
      BPREV  =  0.
C
C  COMPUTE STARTING VALUE OF M
      IF  (X - 5.)  50, 60, 60
   50 MA  =  X + 6.
      GO TO 70
   60 MA  =  1.4 * X + 60. / X
   70 MB  =  N + 2 + IFIX(X) / 4
      MZERO  =  MAX0(MA, MB)
C
C  SET UPPER LIMIT OF M
C
      MMAX  =  NTEST
  100 DO  190  M = MZERO,MMAX,3
C
C  SET F(M), F(M-1)
C
      FM1  =  1.0E-28
      FM  =  0.
      ALPHA  =  0.
      IF  (MOD(M, 2))  120, 110, 120
  110 JT  =  -1
      GO TO 130
  120 JT  =  1
  130 M2  =  M - 2
      DO  160  K = 1,M2
      MK  =  M - K
      BMK  = FLOAT(MK+MK) * FM1 / X - FM
      FM  =  FM1
      FM1  =  BMK
      IF  (MK - N - 1)  150, 140, 150
  140 BJ  =  BMK
  150 JT  =  -JT
      S  =  JT + 1
  160 ALPHA  =  ALPHA + BMK * S
      BMK  =  (FM1+FM1) / X - FM
      IF  (N)  180, 170, 180
  170 BJ  =  BMK
  180 ALPHA  =  ALPHA + BMK
      BJ  =  BJ / ALPHA
      IF  (ABS(BJ - BPREV) - ABS(D * BJ))  200, 200, 190
  190 BPREV  =  BJ
      IER  =  1
  200 BJ  =  SS * BJ
  210 N  =  NT
      X  =  XT
      RETURN
      END
```

```
      SUBROUTINE BLWFLP                                                  BLWFLP
C          COMMON  STORAGE                                               BLWFLP
      DIMENSION PR7(1)                                                   BLWFLP
      COMMON/BLOWIN/PR7,TT7,AN7,DN7,FANG7,DELT7,DL7,HD7,ICOR7            BLWFLP
      COMMON /GCOMGN/ NCF,NK,BCF(24),TSPL(24,10,17),SPLT(24,17),         BLWFLP
     *BUF(25),RETA(17),SPL2(17),TGAGR(24),DCPSF(17)                      BLWFLP
C                                                                        BLWFLP
C     GENERAL INPUT PARAMETERS                                           BLWFLP
      COMMON /GPRAM/ALTP,ALTR,SLOPE,AMACH,NOBS,SLDIST(10),NTENG,IUNIT    BLWFLP
     *    ,ISPTRM,IATMOS,IAIR,UAIRAB(24),NTEMP,TEMP(50),TALT(50)         BLWFLP
     *    ,NPRES,PRES(50),PALT(50),NHUMID,RALT(50),RHUMID(50),CTEMP      BLWFLP
     *    ,CPRES,CRHUMD,IEGA,IGDR,DTEMP,DPRES,DHUMID,XKN,ND,FLD(50),     BLWFLP
     * ZNR(50),ZNI(50),LINECT,MAXLIN,IPAGE,BCC,TCG,FLK,AALT,EPF          BLWFLP
C     AIRCRAFT-OBSERVER GEOMETRY OUTPUTS                                 BLWFLP
      COMMON /GEOMO/ APY(10,17),APZ(10,17),PD(10,17),DPND(10,17),        BLWFLP
     * B1(10,17),B2(10,17),TDS(17,10),TPD(17,10),IRR(10,17)              BLWFLP
     *,APP,TP,RHP,APO,TO,RHO,CA,CZ,TSP(17,10),CCV                        BLWFLP
      COMMON/SWITCH/NTYPE,ITYPE,NENG,IDCP,IPRT(7),ICN(13),NLCPT          BLWFLP
      COMMON/SUMSPL/SSPL(24,10,17)                                       BLWFLP
      COMMON/PNLD/PSPL(17,20),EPNL(5,10),TEPNL(5,10)                     BLWFLP
      COMMON/ANGLE/PSI(17,10),PSIC(17,10),BETA(17,10)                    BLWFLP
      COMMON/HEAD/HIN(20),HOUT(20),CHIN(20)                              BLWFLP
      COMMON/GFREQ/CFREQ(24),UFREQ(25),PFREQ(24)                         BLWFLP
      COMMON/GCONVC/C(2,10),SLCISX(10)                                   BLWFLP
      COMMON/TMSPL/SPZ(24,17),IB(2,3,13)                                 BLWFLP
      COMMON/CRSPLS/DOB(17),PSCR(17),DFB(408),NPSCR                      BLWFLP
C                                                                        BLWFLP
C          PR7        PRESSURE RATIO                                     BLWFLP
C                                                                        BLWFLP
C          TT7        TOTAL TEMPERATURE ( R)                             BLWFLP
C                                                                        BLWFLP
C          AN7       NOZZLE AREA IN SQ. FT.                              BLWFLP
C                                                                        BLWFLP
C          DN7        NOZZLE DIAMETER (FT.)                              BLWFLP
C                                                                        BLWFLP
C          FANG7      FLAP ANGLE ( DEG.)                                 BLWFLP
C          DELT7      ENGINE ATTITUDE ANGLE                              BLWFLP
C                                                                        BLWFLP
C          DL7        DIMENSIONLESS DISTANCE BETWEEN NOZZLE AND TARGET POI BLWFLP
C                                                                        BLWFLP
C          HD7        DIMENSIONLESS HEIGHT I.E., DISTANCE BETWEEN NOZZLE BLWFLP
C                     CENTERLINE AND MEAN CHORD LINE                     BLWFLP
C          ICOR7      CONFIGURATION CORRECTIONS INDICATOR                BLWFLP
      DIMENSION FT1(9),SP1(9),XDN( 6),VXVO( 6),VFA(9),FLA(3),FN3(9),     BLWFLP
     * FTH4(14),FVJ4(3),FN4(14,3,3)                                      BLWFLP
      DIMENSION PT3(5),PVJ3(5)                                           BLWFLP
      DIMENSION AZ5(2),FN5(19,3,2),FTH5(19),FTH6(10),FLDLHR(2),FN6(10,2) BLWFLP
      DIMENSIONFL7(9),FN7(9)                                             BLWFLP
      DIMENSION STN8(25),FN8(25)                                         BLWFLP
      DATA RPD/.017453/,DPR/57.2957/                                     BLWFLP
      DATA R/53.345/,G/32.174/,PI/3.14159/                               BLWFLP
      DATA FT1/800.,900.,1000.,1200.,1400.,1600.,1800.,2000.,2500./      BLWFLP
      DATA SP1/1.382,1.376,1.369,1.357,1.344,1.333,1.324,1.316,1.302/    BLWFLP
      DATA XDN/5.,5.5,6.,6.5,7.,7.2/                                     BLWFLP
      DATA VXVO/1.,.99,.98,.97,.95,.93/                                  BLWFLP
      DATA FLA/0.,15.,45./                                               BLWFLP
      DATA FN3/153.2,157.4,160.,162.6,165.1,167.2,169.2,                 BLWFLP
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```
     *   171.2,172.8/
C
      DATA PT3/553.,495.,474.,439.,404./
      DATA PVJ3/426.,624.,758.,925.,1126./
      DATA FTH4/0.,30.,60.,80.,90.,100.,110.,120.,130.,140.,150.,
     *  160.,170.,180./
      DATA FVJ4/2.79588,2.96614,3.05115/
      DATA FN4 /-5.,-3.,-.5,0.,0.,-.3,-.5,-.8,-1.,-1.2,-1.7,
     *  -2.5,-3.,-3.5,
     2    -4.,-2.,-.5,0.,-.5,-.6,-1.,-1.4,-1.6,-2.4,-3.2,-5.,-4.7,-3.2,
     3    -3.,0.,1.,0.,-1.,-1.8,-3.5,-5.7,-6.5,-5.,-.8,-.2,-.1,-.2,
     4    -4.,-1.5,-.5,0.,.5,.5,.8,1.,1.3,2.,2.7,3.,2.5,2.,
     5    -2.6,-1.6,-.6,0.,.2,0.,.2,1.,2.,2.2,1.5,0.,-.4,0.,
     6    -4.5,-.3,.1,0.,-.1,-.3,-3.1,-5.6,-7.1,-7.6,-.6,.6,.1,-.1,
     7    .4,.6,.1,0.,.1,.3,.4,.5,1.5,2.6,4.,4.2,4.4,4.,
     8    -2.5,-.8,0.,0.,0., .5,.7,1.,1.5,2.1,2.8,1.3,-.4,.2,
     9    -5.4,-1.0,-.2,0.,-.5,-.4,-2.2,-4.5,-6.2,-5.9,-1.,.6,.8,.2/
      DATA AZ5/0.,90./
      DATA FTH5/0.,10.,20.,30.,40.,50.,60.,70.,80.,90.,100.,110.,120.,
     *          130.,140.,150.,160.,170.,180./
      DATA FN5 /57 *0.,
     1 3.5,4.3,5.2,5.8,6.9,6.5,6.8,6.,5.2,6.8,5.,5.8,5.4,4.,2.4,1.8,
     * 1.6,1.3,2.6,
     2 3.8,4.5,4.8,5.6,6.2,6.3,7.2,7.4,7.6,8.2,8.5,7.4,8.,6.4,6.8,4.4,
     * 2.5,2.5,3.7,
     3 3.3,5.2,6.2,7.,5.5,9.2,10.3,11.3,11.5,13.4,10.9,8.4,4.6,-.5,-1.5,
     * 3.8,4.9,2.6,2.8/
      DATA RL/.37/,HR/.078/,DR/.052/
      DATA FTH6/0.,30.,60.,80.,90.,100.,120.,150.,170.,180./
      DATA FLDLFR/ .12,1.0 /
      DATA FN6/2.3,1.6,2.8,3.9,4.1,4.4,4.4,4.1,3.9,3.1,10*0.0 /
      DATA FL7/0.,5.,10.,15.,20.,30.,40.,45.,67.5/
      DATA FN7/.48,.51,.55,.6,.665,.8,.93,1.0,1.31/
      DATA VFA/2.692,2.771,2.817,2.868,2.914,2.955,2.993,3.028,3.060  /
      DATA STN8/-1.8239,-1.4815,-1.301,-1.222,-1.155,-1.097,-1.046,-1.,
     *    -.824,-.699,-.602,-.523,-.456,-.398,-.301,-.222,-.155,
     *    -.097,-.046,0.,.176,.301,.477,.699,.778   /
      DATA FN8/-60.,-40.,-29.5,-25.,-22.,-19.7,-18.,-16.6,-12.4,-10.6,
     *   -9.7,
     *     -9.2,-9.,-9.1,-9.6,-10.3,-10.8,-11.3,-11.9,-12.4,-14.7,-16.4,
     *      -19.,-22.5,-23.7  /
      DATA  C1/3HC1)/
      DATA C25/5HC1-4)/
      DATA CI/3HCI)/,CII/4HCII)/,CIII/5HCIII)/,CIV/4HCIV)/,
     *  CV/3HCV)/,CEND/4HCEND/
      SP7=APO*144.
C2.   CALCULATE   DENSITY
      ICN(7)=ICN(7)+1
      DELTA=DELT7*.01745
      CALL ANGLES(NOBS,DELTA)
      GAMA=TBLU1(TT7,FT1,SP1,1,9)
      RT=R*TT7
      RHOS  = (SP7 / RT) * PR7(1)**((GAMA-1.)/GAMA)
C3.   VALCULATE JET VELOCITY VJ
      VJ  = SQRT((2.*G*RT*GAMA/(GAMA-1.))*(1.-PR7(1)**((1.-GAMA)/GAMA)))
C4.   CALCULATE JET MACH NUMBER AMJ
      AMJ  = SQRT((2./(GAMA-1.))*(PR7(1)**((GAMA-1.)/GAMA) - 1.))
```

```
      TS  =  TT7 * PR7(1)**((1.-GAMA)/GAMA)                            BLWFLP
      ALPHA=DELTA-ATAN(SLOPE)                                          BLWFLP
C5.                                                                    BLWFLP
      VA=CZ*AMACH                                                      BLWFLP
      IF(DL7.GT.5.)GO TO 10                                            BLWFLP
      VXVJ=1.0                                                         BLWFLP
      GO TO 30                                                         BLWFLP
 10   IF(DL7.GT.7.4)GO TO 20                                           BLWFLP
      VXVJ=TBLU1(DL7,XDN,VXVC,2,6)                                     BLWFLP
      GO TO 30                                                         BLWFLP
 20   VXVJ=6.768*DL7*.1                                                BLWFLP
 30   CONTINUE                                                         BLWFLP
      VX=VXVJ*VJ                                                       BLWFLP
      VF=SQRT(VX**2+(1.0-VXVJ)**2*VA**2+2.*VX*VA*(1.-VXVJ)*COS(ALPHA)) BLWFLP
C6.   CALCULATE OVERALL SOUND PRESSURE LEVEL  DB                       BLWFLP
CI)   **  NORMALIZED OVERALL SPL AS A FUNCTION OF VF AT PSI=80, AZANG7=0 BLWFLP
      AVF=ALOG10(VF)                                                   BLWFLP
      VFNI=TBLU1(AVF,VFA,FN3,1,9)                                      BLWFLP
      TSZ=TBLU1(VJ,PVJ3,PT3,1,5)                                       BLWFLP
      SPLI=VFNI+15.*ALOG10(TS/TSZ)+10.*ALOG10(RHOS**2*AN7)             BLWFLP
     *    +10.*ALOG10((.0526+(SIN(FANG7*RPD)**2))/1.0526)              BLWFLP
      DO 4000 I=1,NOBS                                                 BLWFLP
      CALL LINCOR(SPZ(1,1),0,X,X,X,X,X,X,X,X,X,PSI(1,I),NCF,BCF,       BLWFLP
     * X,X,X,X,X,X,X,ICOR7,IB(1,1,ITYPE),0,X)                          BLWFLP
      DO 1000 J=1,17                                                   BLWFLP
C                                                                      BLWFLP
CII)  **  CORRECTION OVERALL SPL AT GIVEN PSI AND  AZANG7=0            BLWFLP
C                                                                      BLWFLP
      VVJ=ALOG10(VJ)                                                   BLWFLP
      SPLII=TBLU3(PSI(J,I),FANG7,VVJ,FTH4,FLA,FVJ4,FN4,1,1,1,          BLWFLP
     *    14,3,3,14,3,3)                                               BLWFLP
C                                                                      BLWFLP
CIII) **  CORRECTION TO OVERALL SPL FOR  CHANGE IN  AZANG7             BLWFLP
C                                                                      BLWFLP
      AZANG7=90.-BETA(J,I)                                             BLWFLP
      SPLIII=TBLU3(PSI(J,I),FANG7,AZANG7,FTH5,FLA,AZ5,FN5,1,1,1,       BLWFLP
     * 19,3,2,19,3,2)                                                  BLWFLP
C                                                                      BLWFLP
CIV)      CORRECTION TO OVERALL SPL FOR CHANGES IN RELATIVE LOCATIONS  BLWFLP
C                  OF NOZZLE AND WING                                  BLWFLP
      FL=DL7*HD7                                                       BLWFLP
      SPLP=FL/(RL*HR/DR**2)                                            BLWFLP
          ETAS= TBLU1(FANG7,FL7,FN7,1,9)                               BLWFLP
      CPSZ=PSI(J,I)-ALPHA*DPR                                          BLWFLP
      SPLIV=TBLU2(CPSZ,SPLP,FTH6,FLDIFF,FN6,1,1,10,2,10,2)             BLWFLP
      SPLIV=SPLIV*ETAS                                                 BLWFLP
CV)       CHANGES IN SOUND INTENS TY DUE TO FLIGHT EFFECTS             BLWFLP
      ONEM=1.-AMACH*COS(BETA(J))                                       BLWFLP
      SPLV=-30.*ALOG10(ONEM)                                           BLWFLP
C       OVERALL SPL                                                    BLWFLP
      OASPL=SPLI+SPLII-SPLIII+SPLIV+SPLV-3.                            BLWFLP
      XENG=NENG                                                        BLWFLP
                            ENS = ESHLDG(PSIO(J,I),BETA(J,I),XENG)     BLWFLP
      DO  800  NB=1,NCF                                                BLWFLP
      TGAGR(NB)=BCF(NB)*DN7*ONEM/(VF*SQRT(1.+(SIN(RPD*FANG7)           BLWFLP
     *    **2)*.5))                                                    BLWFLP
      TTEMP=TGAGR(NB)                                                  BLWFLP
```

```
      TGAGR(NB)=TBLU1(ALOG10(TGAGR(NB)),STN8,FN8,1,24)
      IF(NCF.EQ.8)TGAGR(NB)=TGAGR(NB)+ 4.8
      SPLT(NB,J)=OASPL+TGAGR(NB)-ENS-SPZ(NB,J)
      SSPL(NB,I,J)=PWRSUM(SSPL(NB,I,J),SPLT(NB,J))
  800 CONTINUE
 1000 CONTINUE
      IF(IPRT(7).NE.7)GO TO 2200
      CALL NOISO(IPRT(7),I,NK,10,CHIN,IUNIT,SLDISX(I),PFREQ,
     1     SPLT(1,1),NCF,ITYPE)
 2200 CONTINUE
      DO 2500  K=1,NCF
      DO 2500  J=1,17
 2500 SPLT(K,J)=SPLT(K,J)-TSPL(K,I,J)
      IF(IPRT(3).NE.3)GO TO 3000
      CALL  PNLSUB(SPLT(1,1),PSPL(1,I),TPD(1,I),EPNL(1,I),SPL2,
     *      TEPNL(1,I),NK,BCG,TCG,FLK, I,NOBS,IRR(I,1))
      CALL NOISO(IPRT(3),I,NK,12,CHIN,IUNIT,SLDISX(I),
     1   PFREQ,SPLT(1,1),NCF,ITYPE)
 3000 CONTINUE
 4000 CONTINUE
      RETURN
      END
```

```
      SUBROUTINE BUZSAW(RTS,FBPF,DIAM,XSF,ANGLES,ILEVEL,IDOP,
     *                  BSCR1,BSCR3,BSARAY)
C AUTHOR              D. F. MELDRUM
C
C METHOD              THE BUZZSAW NOISE IS PREDICTED BY THE USE OF CURVES
C                     AS PER THE REFERENCE GIVEN.
C                     THESE CURVES ARE INTERPOLATED OR EXTRAPOLATED AS
C                     NEEDED INORDER TO PREDICT THE NOISE AT 150 FT RADIUS
C
C PURPOSE             TO PREDICT THE BUZZSAW NOISE COMPONENT FOR EACH
C                     STAGE OF THE INLET FAN.
C
C INPUTS              RTS       RELATIVE FAN TIP SPEED IN FT/SEC.
C                     FBPF      FUNDAMENTAL BLADE PASSING FREQUENCY HERTZ
C                     DIAM      FAN INLET DIAMETER IN FEET
C                     XSF       SCALE FACTOR FOR THE DOPPLAR SHIFT
C                     ANGLES    DIRECTIVITY ANGLES FOR NOISE PREDICTION
C                     ILEVEL    SWITCH FOR THE DOPPLAR SHIFT LEVEL
C                               CORRECTION IF NON ZERO
C                     IDOP      SWITCH FOR THE DOPPLAR SHIFT FREQUENCY
C                               CORRECTION IF IT SET NON ZERO
C                     BSCR1     CURVE - BUZZSAW - BASIC DATA
C                     BSCR3     CURVE - BUZZSAW - DIRECTIVITY ANGLE
C
C                     INPUT VIA LABLED COMMON - GFREQ
C                     BANDLM    1/3 OCTAVE BAND LIMITS
C
C OUTPUTS             BSARAY    TABLE OF BUZZSAW NOISE COMPONENT
C                               THIS NOISE IS ADDED TO ANY NOISE WHICH
C                               MAY ALREADY BE IN BSARAY. THEREFORE IF
C                               ONLY THE BUZZSAW NOISE IS DESIRED THIS
C                               ARRAY MUST BE SET TO ZERO BEFOR CALLING
C                               THIS SUBROUTINE.
C
C MODIFICATIONS       FROM TEE205 INTO TEE215 - THIS WAS TAKEN FROM
C                     TEE215 AND CHANGES MADE FOR THE NASA-AMES CONTRACT
C
C REFERENCES          COORD SHEET AMEP-M-367  3/17/72  D. MELDRUM  TEE205A
C                     ANS-RES-F-327           5/30/72  D. SCHRANK
C                     R. J. SAXBY,  NASA-AMES FOOTPRINT CONTRACT
C                         NAS2-6969  FAN NOISE MODULE,   UN-NUMBERED
C                         COORDINATION SHEET,  DATED 19 JANUARY 1973.
C
C FUNCTION SUBPRGM  ALOGIC    TBLU1     PWRSUM
C
C
      COMMON /GFREQ/ CFREQ(24),BANDLM(25)
C
      DIMENSION BSARAY(24,1),BSCR1(1),BSCR3(1)
      DIMENSION ANGLES(1),XSF(1)
      DATA NFREQ/24/
C
C     CALCULATE THE ENGINE SIZE CORRECTION
C
      BS=20.0*ALOG10(DIAM)
C
C     CALCULATE THE BASIC NOISE FOR THE BUZZSAW NOISE
```

```
C
      IX=2
      NUM=BSCR1(IX-1)
      IY=NUM+IX
      BS2=BS+TBLU1(RTS,BSCR1(IX),BSCR1(IY),1,NUM)
      IX=NUM*2+IX+1
      NUM=BSCR1(IX-1)
      IY=NUM+IX
      BS4= BS+TBLU1(RTS,BSCR1(IX),BSCR1(IY),1,NUM)
      IX=NUM*2+IX+1
      NUM=BSCR1(IX-1)
      IY=NUM+IX
      BS8= BS+TBLU1(RTS,BSCR1(IX),BSCR1(IY),1,NUM)
C
C     IDENTIFY THE BANDS WITH DISCRETE TONES
C
      DO 100 K=1,17
      IF(ANGLES(K).LT.0.0-.01) GO TO 100
      IF(ANGLES(K).GT.100.0+.01) GO TO 100
      SF=0.0
      IF(ILEVEL.NE.0) SF=-40.0*ALOG10(XSF(K))
      FREQ=FBPF
      IF(IDUP.NE.0) FREQ=FREQ/XSF(K)
   65 AN=10.0*ALOG10(FREQ/10000.)+24.
C
C     CALCULATE THE BASIC SPECTRUM
C
      DO  200  J = 1,NFREQ
      A=J
      ABAND2=A-AN+3.0
      ABAND4=A-AN+6.0
      ABAND8=A-AN+9.0
      DELTA1  =  ABS(ABAND2) * 3.
      DELTA2  =  ABS(ABAND4) * 5.
      DELTA3=-5.0*ABAND8
      IF(ABAND8.GT.0.0) DELTA3=3.0*ABAND8
      SPLTOT=BS2+SF-DELTA1
      SPLTMP=BS4+SF-DELTA2
      SPLTOT=PWRSUM(SPLTOT,SPLTMP)
      SPLTMP=BS8+SF-DELTA3
      SPLTOT=PWRSUM(SPLTOT,SPLTMP)
C
      IX=2
      NUM=BSCR3(IX-1)
      IY=NUM+IX
C
C     GENERATE THE TABLE OF BUZZSAW NOISE
C
      BSDATA=SPLTOT+TBLU1(ANGLES(K),BSCR3(IX),BSCR3(IY),1,NUM)
      BSARAY(J,K)=PWRSUM(BSARAY(J,K),BSDATA)
  200 CONTINUE
  100 CONTINUE
      RETURN
      END
```

```
      COMPLEX FUNCTION CFI(X)
C
C PURPOSE-
C     COMPUTES THE COMPLEX FRESNEL INTEGRAL OF THE FORM-
C
C     SQRT(I*PI) * F(X)  =  INTEGRAL( EXP(I * Z**2) * DZ )  OVER THE
C                           LIMITS  (X, +INF.)
C INPUT-
C     X  ...  ANY REAL VARIABLE (POSITIVE, ZERO, OR NEGATIVE)
C
C OUTPUT-
C     F  ...  COMPLEX RESULT FOR FUNCTION IN THE FORM (A + I*B) WHERE
C             (A, B) ARE REAL NUMBERS.
C
C AUTHOR-  D.G. DUNN     (5 SEP. 1974)
C
C REFERENCE-
C     1) IBM CORP., /SCIENTIFIC SUBROUTINE PACKAGE/, IBM APPLICATION
C        PROGRAM H20-0166-5, 1968, P.371
C     2) BOERSMA, /COMPUTATION OF FRESNEL INTEGRAL/, MATHEMATICAL TABLES
C        AND OTHER AIDS TO COMPUTATION, VOL.14, NO.72, 1960, P.380
C     3) M. ABRAMOWITZ AND I.A. SEGAN, /HANDBOOK OF MATHEMATICAL
C        FUNCTIONS/, DOVER PUBLICATIONS,INC., NEW YORK, 5TH EDIT.,1968
C
C  COMMENTS-
C    1) ARGUMENT (X) REMAINS UNCHANGED
C    2) NO OTHER SUBPROGRAMS REQUIRED OVER STANDARD FORTRAN IV LIBRARY.
C    3) ABSOLUTE ERROR IS LESS THAN 1.2E-7
C.......................................................................
      DATA P5, F4 /0.5, 4.0/
      CFI  =  (0.5, 0.0)
      Z    =  X*X
      IF  (Z)  50, 50, 10
   10 IF  (Z - F4)  20, 20, 30
   20 C  =  ABS(X)
      S  =  Z * C
      Z  =  16. - Z*Z
      C  = C * ((((((5.100785E-11 * Z + 5.244297E-9) * Z + 5.451182E-7)
     1* Z + 3.273308E-5) * Z + 1.020418E-3) * Z + 1.102544E-2) * Z +
     2 1.840962E-1)
      S  = S * (((((6.677681E-10 * Z + 5.883158E-8) * Z + 5.051141E-6)
     1* Z + 2.441816E-4) * Z + 6.121320E-3) * Z + 8.026490E-2)
      GO TO 40
   30 D  =  COS(Z)
      S  =  SIN(Z)
      Z  =  F4 / Z
      A  =  (((((((8.768258E-4 * Z - 4.169289E-3) * Z + 7.970943E-3) *
     1Z - 6.792801E-3) * Z - 3.095341E-4) * Z + 5.972151E-3) * Z -
     2 1.606428E-5) * Z - 2.493322E-2) * Z - 4.444091E-9
      B  =  ((((((-6.633926E-4 * Z + 3.401409E-3) * Z - 7.271690E-3) *
     1Z + 7.428246E-3) * Z - 4.027145E-4) * Z - 9.314910E-3) * Z -
     2 1.207998E-6) * Z + 1.994711E-1
      Z  =  SQRT(Z)
      C  =  P5  + Z * (D * A + S * B)
      S  =  P5  + Z * (S * A - D * B)
   40 C  =  SIGN(C, X)
      S  =  SIGN(S, X)
```

```
      CFI  =  CMPLX(P5 - P5 * (C + S), P5 * (C - S))                  CFI
   50 RETURN                                                          CFI
      END                                                             CFI
```

```
      SUBROUTINE CMAXIS(X,Y,IBCD,NCHAR,AXLEN,ANGLE,FIRST,DELTV)
C
C AUTHOR              K.D. JOHNSON
C
C PURPOSE             PLOT AXIS BEGINNING AT(XP,YP)IN ANGLE THETA
C                     DIRECTION
C                     TIC MARKS ARE AT CENTIMETER INCREMENTS
C                     AXIS IS LABELED AT EVERYOTHER TIC MARK
C
C INPUTS              X = BEGINNING X COORDINATE IN CM
C                     Y = BEGINNING Y COORDINATE IN CM
C                     IBCD = THE TITLE WHICH IS PLACED AT THE FAR END OF
C                              THE AXIS
C                     NCHAR= THE NUMBER OF CHARACTERS IN THE TITLE IBCD
C                           IF NCHAR  0 THE TITLE APPEARS ON POSITIVE SI
C                           OF AXIS
C                           IF NCHAR IC  THE TITLE APPEARS ON NEGATIVE
C                           SIDE OF AXIS
C                     AXLEN=AXIS LENGTH IN CM
C                     FIRST = VALUE OF AXIS AT(XP,YP)
C                     DELTV = INCREMENT VALUE(UNITS/CM)
C                     ANGLE = ANGLE, IN POSITIVE OR NEGATIVE DEGRESS AT
C                           WHICH THE AXIS IS DRAWN (+X=0.+Y=90.)
C
C
C 360
C     DIMENSION IBCD(1),PLABL(2)
      DIMENSION IBCD(1),PLABL(1)
      INTEGER CMOV
C     DATA PLABL(1)/4H  * /, PLABL(2)/4H10** /
      DATA PLABL/8H * 10**  /
      DATA CMPIN /2.54001/
      DATA  RADIAN/ 57.29577/
C
C  CONVERT ANGLE TO RADIANS
C
      THETA=ANGLE/RADIAN
C
C
C  CONVERT SCALE TO UNITS/INCH
      DELCM=DELTV*CMPIN
C
C MOVE TO START OF AXIS
      XP=X/CMPIN
      YP=Y/CMPIN
      CALL PLOT(XP,YP,3)
      LINC=AXLEN
      COSTH=COS(THETA)
      SINTH=SIN(THETA)
      CMCSTH=COSTH/CMPIN
      CMSNTH=SINTH/CMPIN
      XTIC=.07*SINTH
      YTIC=.07*COSTH
      CALL PLOT(XP+XTIC,YP+YTIC,2)
      CALL PLOT(XP-XTIC,YP-YTIC,2)
      CALL PLOT (XP,YP,2)
      DO 25 I=1,LINC
      XP=XP+CMCSTH
```

```
      YP=YP+CMSNTH
      CALL PLOT(XP,YP,2)
      CALL PLOT(XP+XTIC,YP+YTIC,2)
      CALL PLOT(XP-XTIC,YP-YTIC,2)
      CALL PLOT(XP,YP,2)
25    CONTINUE
C  FIND POWER DIVISOR NECESSARY FOR F XX.X LABEL FORMAT
      AMAX=DELTV*AXLEN+FIRST
      IP=MCHAR(AMAX)-2
      INCHR=IABS(NCHAR)
      RINCH  =  INCHR
      NADD=0
      IF(IP.EQ.0)GO TO 28
      NADD=10
28    NTCHAR=INCHR+NADD
      TNCHAR  =  NTCHAR
      ISCHAR=ISIGN(1,NCHAR)
      SICHAR  =  ISCHAR
      XPL  =  XP - .13 * TNCHAR * COSTH
      YPL  =  YP - .13 * TNCHAR * SINTH
      XPL  =  XPL - .42 * SICHAR * SINTH
      YPL  =  YPL + .42 * SICHAR * COSTH
      CALL SYMBOL(XPL,YPL,.14,IBCD,ANGLE,INCHR)
      IF(NADD.EQ.0)GO TO 29
      XPL  =  XPL + .13 * RINCH * COSTH
      YPL  =  YPL + .13 * RINCH * SINTH
      CALL SYMBOL(XPL,YPL,.14,PLABL,ANGLE,8)
      XPL=XPL+1.04*COSTH
      YPL=YPL+1.04*SINTH
      FPN=IP
      CALL NUMBER(XPL,YPL,.14,FPN,ANGLE,-1)
C
C LABEL VALUES EVERYOTHER CM TIC MARK
C
29    XMAX=0.
      TWODLT=DELTV*2.
30    XMAX=XMAX+TWODLT
      IF(XMAX.LT.AMAX) GO TO 30
      AMAX=XMAX-TWODLT
      XMAX=(AMAX-FIRST)/DELCM
      XP=X/CMPIN
      YP=Y/CMPIN
      XP=XP+XMAX*COSTH
      YP=YP+XMAX*SINTH
      XP  =  XP - 3. * XTIC * SICHAR
      YP  =  YP + 3. * YTIC * SICHAR
      POWR=10.**IP
35    FPN=AMAX/POWR
      FP=ABS(FPN)
      NDEC=1
      IF  (FP .NE. 0.)  GO TO 40
      CMOV=1
      GO TO 42
40    CMOV=MCHAR(FP)
      IF  (CMOV .GT. 0)  GO TO 42
      CMOV=2
      NDEC=3
```

```
42    IF(FPN.LT.0.) CMOV=CMOV+1                                  CMAXIS    116
      XPN  =  XP - .07 * COSTH * FLOAT(CMOV)                     CMAXIS    117
      YPN  =  YP - .07 * SINTH * FLOAT(CMOV)                     CMAXIS    118
      CALL NUMBER(XPN,YPN,.07,FPN,ANGLE,NDEC)                    CMAXIS    119
      AMAX=AMAX-2.*DELTV                                         CMAXIS    120
      XP=XP-2.*CMCSTH                                            CMAXIS    121
      YP=YP-2.*CMSNTH                                            CMAXIS    122
      IF(AMAX.GE.FIRST) GO TO 35                                 CMAXIS    123
      RETURN                                                     CMAXIS    124
      END                                                        CMAXIS    125
```

```
      SUBROUTINE CONVR(IENTRY,N,L)
C
C     INPUT DATA BLOCKS FOR NOISE COMPONENTS
C     ITYPE DEFINES THE TYPE OF NOISE COMPONENT
C ITYPE=1  PRIMARY JET
C  =2      PRIMARY AND SECONDARY JET
      COMMON/JETDAT/NJET1,MCODE1,AP1,WP1,VP1,AS2,WS2,VS2,PR1,PA1,
     1    TT1,VA1,DIAMT1,ANGJT1,ICOR1
      DIMENSION JETD(12)
      EQUIVALENCE (JETD(1),AP1)
C  =3      CORE AND TURBINE
      COMMON/COREIN/TT3,PP3,CMF3,EK3,DELT3,J83,
     *  ICOR3,LIN3,NTF3,IMA3,LGM3,NWL3,ICP3,ILAY3,TF3(10),
     *  PCTA3(10),PLA3(10),ELCH3,EDH3,R1W3(10),TL3(10),CF3,FM3
C
      COMMON/TURBIN/DN3,SS3,VTR3,CLS3,CT3,TU3,FMF3,CS3,IC3,ISW3
C  =4      COMPRESSOR AND INLET FAN
C  =5      EXIT FAN
      COMMON/FANDAT/NSTG45,NLET45,NAFT45,ICP45,NB45(3),FPR45(3),
     1  DIAM4(3),RSS45(3),AREA5(3),RN145,RTS4,CFPR45,DELT45,
     *  NI5,BPR5,ICOR4,LIN4,NTF4,IMA4,LGM4,NWL4,ICP4,ILAY4,TF4(10),
     *  PCTA4(10),PLA4(10),ELCH4,EDH4,R1W4(10),TL4(10),CF4,FM4,
     *  ICOR5,LIN5,NTF5,IMA5,LGM5,NWL5,ICP5,ILAY5,TF5(10),
     *  PCTA5(10),PLA5(10),ELCH5,EDH5,R1W5(10),TL5(10),CF5,FM5
C  =6      AUGMENTER-WING JET
      COMMON/SWITCH/NTYPE,ITYPE,NENG,ICCP,IPRT(7),ICN(13),NLOPT
      COMMON/AUGWNG/GAMA6,TT6,XNPR6,DELT6,AL6,CE6,
     *  ICOR6,LIN6,NTF6,IMA6,LGM6,NWL6,ICP6,ILAY6,TF6(10),
     *  PCTA6(10),PLA6(10),ELCH6,EDH6,R1W6(10),TL6(10),CF6,FM6
C  =7      BLOWN-FLAP JET
      COMMON/BLOWIN/PR7,TT7,AN7,DN7,FANG7,DELT7,DL7,HD7,ICOR7
C  =8      LIFT FAN
      COMMON/LFTFAN/NB8,FPR8,DIAM8,RSS8,AREA8,RN18,RTS8,CRFPR8,DELTA8,
     *  ICOR8,LIN8,NTF8,IMA8,LGM8,NWL8,ICP8,ILAY8,TF8(10),PCTA8(10),
     *  PLA8(10),ELDH8,EDH8,R1W8(10),TL8(10),CF8,FM8
C  =9     EJECTOR-SUPRESSOR
      COMMON /EJECTD/ IEJ9,NUM9,AREA9,AR9,TT9,EXNM9,SMACH9,CV9,PS9,
     *  PA9,PTS9,EMACH9,PCV9,DELT9,
     *  ICOR9,LIN9,NTF9,IMA9,LGM9,NWL9,ICP9,ILAY9,TF9(10),PCTA9(10),
     *  PLA9(10),ELDH9,EDH9,R1W9(10),TL9(10),CF9,FM9
C  =9      LIFT-FAN
C  =10     PROPELLER
      COMMON/PROPIN/T10,W10,RPM10,D10,DSUB10,ASUB10,B10,DELT10,
     *ICOR10
C  =11     HELICOPTER AND TILT ROTOR
      COMMON/COPTER/T11,Q11,RPM11,B11,CT11,AB11,CE11,RN11,
     1       SI11,CEE11,DELT11,XLMC11,XM11,NRTH11,LLF11,
     *IRP11,ICOR11
C
C  =12     MEASURED DATA INPUTS
      COMMON/MEASIN/NEP12,NPSI12,NBTA12,DELT12,EP12(5),PSI12(17),
     *    BETA12(5),
     *ICOR12
C
C IBM360
C     THIS ROUTINE HANDLES LINKAGE TO INPUT MODULES  FLIGHT-PATH
C     OBSERVER GEOMETRY MODULE  VARIOUS NOISE ESTIMATION MODULES
```

```
C      EXTRAPOLATION MODULE  HUMAN RESPONSE MEASUREMENT MODULE
C      INTERGER XTRANSF
C
C      CONSTANTS USED IN INTERNAL CALCULATIONS
C
       COMMON /GCONST/ IN,IO,IT1,IT2,F0,F1,F2,F3,F4,F5,F6,F7,F8,F9,F10,
     *                 I0,I1,I2,I3,I4,I5,I6,I7,I8,I9,I10,P1,P33,P5,P001,
     *                 EPS,UNDEF,BL,ICD,LPR,RPD,ETA(17),M1,FM1,I17,A,PI
C
C      VARIABLE SET CALCULATED IN THE PROGRAM PROCESSING
C
       COMMON /GCOMON/ NCF,NK,BCF(24),TSPL(24,10,17),SPLT(24,17),
     *BUF(25),RETA(17),SPL2(17),TGAGR(24),DCPSF(17)
C
C      FREQUENCY BANDS USED BY PROGRAM
C
       COMMON /GFREQ/ CFREQ(24),UFREQ(25),PFREQ(24)
C
C      GENERAL INPUT PARAMETERS
C
       COMMON /GPRAM/ALTP,ALTR,SLOPE,AMACH,NCBS,SLDIST(10),NTENG,IUNIT
     *     ,ISPTRM,IATMOS,IAIR,LAIRAB(24),NTEMP,TEMP(50),TALT(50)
     *     ,NPRES,PRES(50),PALT(50),NHUMID,RALT(50),RHUMID(50),CTEMP
     *     ,CPRES,CRHUMD,IEGA,IGDR,DTEMP,DPRES,DHUMID,XKN,ND,FLD(50),
     * ZNR(50),ZNI(50),LINECT,MAXLIN,IPAGE,BCG,TCG,FLR,AALT,EPF
C
C      AIRCRAFT-OBSERVER GEOMETRY OUTPUTS
C
       COMMON /GEOMO/ APY(10,17),APZ(10,17),PD(10,17),DPND(10,17),
     * B1(10,17),B2(10,17),TDS(17,10),TPD(17,10),IRR(10,17)
     *,APP,TP,RHP,APO,TC,RHC,CA,CZ,TSP(17,10),CCV
C
C      CONVERSION CONSTANTS
C
       COMMON/GCONVC/C(2,10),SLDISX(10)
       COMMON/CRSPLS/DUB(17),PSCR(17),DFB(408),NPSCR
       COMMON/ICPATH/NCAS,NCOF,NTYP,IC,NRN,IARRAY(2)
C
C
       COMMON/HEAD/HIN(20),HOUT(20),CHIN(20)
C
C              C(1,1)       FEET PER METER
C
C              C(1,2)       LBF PER NEWTON
C
C              C(1,3)       LBS PER KG
C
C              C(1,4)       HP. PER KILOWATT
C              C(1,6)       LBS. PER SQ. IN PER ATMOSPHERE
C
C              C(1,5)       RANKIN PER KEVIN DEGREE
C
       REAL JETD
       LM2  =  L - 2
       IF  (LM2)  1000, 1000, 2
 1000  CONTINUE
       GO TO(1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20),IENTRY
```

```
2     CONTINUE
      JETD(4)=JETD(4)*C(N,1)**2
      JETD(5)=JETD(5)*C(N,3)
      JETD(6)=JETD(6)*C(N,1)
1     CONTINUE
      JETD(1)=JETD(1)*C(N,1)**2
      JETD(2)=JETD(2)*C(N,3)
      JETD(3)=JETD(3)*C(N,1)
      JETD(9)=JETD(9)*C(N,5)
      JETD(11)=JETD(11)*C(N,1)
      IF  (LM2)  2000, 2000, 3
3     CONTINUE
      TT3=TT3*C(N,5)
      CMF3=CMF3*C(N,3)
      VTR3=VTR3*C(N,1)
      CLS3=CLS3*C(N,1)
      DT3=DT3*C(N,1)
      TU3=TU3*C(N,5)
      PMF3=PMF3*C(N,3)
      EDH3=EDH3*C(N,1)
      DO 301 I=1,21
301   R1W3(I)=R1W3(I)*C(N,1)
      IF  (LM2)  2000, 2000, 4
4     CONTINUE
      DO 41 I=I1,NSTG45
41    DIAM4(I)=DIAM4(I)*C(N,I1)
      EDH4=EDH4*C(N,1)
      DO 401 I=1,21
401   R1W4(I)=R1W4(I)*C(N,1)
      IF  (LM2)  2000, 2000, 5
5     CONTINUE
      DO 51 I=1,NSTG45
51    AREA5(I)=AREA5(I)*C(N,1)**2
      EDH5=EDH5*C(N,1)
      DO 501 I=1,21
501   R1W5(I)=R1W5(I)*C(N,1)
      IF  (LM2)  2000, 2000, 6
6     TT6=TT6*C(N,5)
      AD6=AD6*C(N,1)**2
      DE6=DE6*C(N,1)
      EDH6=EDH6*C(N,1)
      DO 601 I=1,21
601   R1W6(I)=R1W6(I)*C(N,1)
      IF  (LM2)  2000, 2000, 7
7     CONTINUE
      TT7=TT7*C(N,5)
      AN7=AN7*C(N,1)**2
      DN7=DN7*C(N,1)
      IF  (LM2)  2000, 2000, 8
8     CONTINUE
      DIAM8=DIAM8*C(N,1)
      AREA8=AREA8*C(N,1)**2
      EDH8=EDH8*C(N,1)
      DO 801 I=1,21
801   R1W8(I)=R1W8(I)*C(N,1)
      IF  (LM2)  2000, 2000, 9
    9 CONTINUE
```

```
      EDH9=EDH9*C(N,1)
      DO 901 I=1,21
901   R1W9(I)=R1W9(I)*C(N,1)
      TT9=TT9*C(N,5)
      AREA9=AREA9*C(N,1)**2
      PA9=PA9*C(N,1)**2
      PS9=PS9*C(N,I6)
      PTS9=PTS9*C(N,5)
      IF  (LM2)  2000, 2000, 10
10    CONTINUE
      T10=T10*C(N,2)
      W10=W10*C(N,4)
      D10=D10*C(N,1)
      DSUB10=DSUB10*C(N,1)
      ASUB10=ASUB10*C(N,1)**2
      IF  (LM2)  2000, 2000, 11
11    CONTINUE
      T11=T11*C(N,2)
      Q11=Q11*C(N,1)*C(N,2)
      DT11=DT11*C(N,1)
      AB11=AB11*C(N,1)**2
      DE11=DE11*C(N,I1)
      IF  (LM2)  2000, 2000, 12
12    CONTINUE
      IF  (LM2)  2000, 2000, 13
13    CONTINUE
      IF  (LM2)  2000, 2000, 14
14    CONTINUE
15    CONTINUE
16    CONTINUE
17    CONTINUE
18    CONTINUE
19    CONTINUE
200   DO 250 I=I1,NOBS
      DO 250 J=I1,I17
      APY(I,J)=C(N,I1)*APY(I,J)
      APZ(I,J)=C(N,I1)*APZ(I,J)
      PD(I,J)=C(N,I1)*PD(I,J)
250   CONTINUE
      CA=CA*C(N,I1)
      CZ=CZ*C(N,I1)
      COV=COV*C(N,I1)
C
20    CONTINUE
      ALTP=C(N, I1)*ALTP
      AALT=C(N,I1)*AALT
      ALTR=C(N,I1)*ALTR
      DO 110 I=I1,NOBS
110   SLDIST(I)=C(N,I1)*SLDIST(I)
      DO 112 I=I1,NTEMP
      TEMP(I)=C(N,I5)*TEMP(I)
 112  TALT(I)=C(N,I1)*TALT(I)
      DO 113 I=I1,NPRES
      PRES(I)=C(N,I6)*PRES(I)
 113  PALT(I)=C(N,I1)*PALT(I)
      DO 114 I=I1,NHUMID
 114  RALT(I)=C(N,I1)*RALT(I)
```

```
      CTEMP=C(N,I5)*CTEMP
      CPRES=C(N,I6)*CPRES
      DTEMP=C(N,I5)*DTEMP
      DPRES=C(N,I6)*DPRES
      DO 125 I=1,24
  125 UAIRAB(I)=UAIRAB(I)/C(N,I1)
 2000 RETURN
      END
```

```
      SUBROUTINE COPTR
C
C
      COMMON /COPTER/ T, Q, THETA, NFL, CT, AB, DE, RN, S, XC, DELTA,
     * XLC, XM, NROT, LLF, ITR, ICCR
      COMMON/SWITCH/NTYPE,ITYPE,NENG,IDCP,IPRT(7),ICN(13),NLOPT
      COMMON /GCONST/ IN, IO, WK1(29), INDEF, BL, ICD, WK2(24)
      COMMON /GCOMON/ NFB, NK, BCF(24), XDB(24,10,17), SPL(24,17), F(25)
     * , RETA(17), SPL2(17), PS(24), SF(17)
      COMMON /SUMSPL/ TSPL(24,10,17)
      COMMON /PNLD/ PNL(17,20), EPNL(5,10), TEPNL(5,10)
      COMMON /GFREQ/ WK3(49), PFREQ(24)
      COMMON /ANGLE/ PSI(17,10), PSIC(17,10), BETA(17,10)
      COMMON /GPRAM/ ALTP, ALTR, GRAD, MO, NOBS, X(10), ITENG, IUNIT,
     * WK4(493), BCG, TCG, FLR, AALT, EPP
      COMMON /GEOMO/ Y(10,17), ZN(10,17), P(10,17), WK5(680), TPO(17,10)
     * , IRR(10,17), WK6(3), PSO, TSO, WK7(2), AO, WK8(171)
      COMMON /GCONVC/ WK9(20), CX(10)
      COMMON/TMSPL/CDB(24,17),IB(2,3,13)
      COMMON /HEAD/ WK10(40), CHIN(20)
      REAL      NBL, MC, MT, MOX, MTE, KN, INDEF, ME
C
C  AUTHOR-   D.G. DUNN                DATE -  6 AUC 73
C
C  PURPOSE-
C       TO COMPUTE THE ROTOR NOISE AS DEFINED IN REF. 2
C
C  INPUTS--  VIA COMMON BLOCKS
C    0) X      ... AIRCRAFT COORDINATES, REF.1
C    1) Y      ... AIRCRAFT COORDINATES, REF. 1
C    2) ZN     ... AIRCRAFT COORDINATES, REF. 1
C    3) P      ... PROPAGATION DISTANCES,REF. 1
C    4) SF     ... DOPPLER-SHIFT FACTORS,REFS. 1 AND 2.  SF  .GT. 0.
C    5) F      ... CUTOFF-FREQUENCIES FOR PASSBAND FILTERS, HZ. REF.1
C    8) NFB    ... NUMBER OF PASSBANDS. 1 .LE. NFB .LE. 24
C   10) NOBS   ... NUMBER OF OBSERVER POSITIONS.  NOBS .GE. 1
C   11) T      ... THRUST PER ROTOR, LBF
C   12) Q      ... SHAFT TORQUE, FT-LBF
C   13) THETA  ... SHAFT SPEED, RPM
C   14) NROT   ... NUMBER OF ROTORS
C   15) NBL    ... NUMBER OF BLADES PER ROTOR
C   16) DT     ... TIP DIAMETER, FT.
C   17) AB     ... BLADE-AREA OF ROTOR, SQ.FT. ... ONE SIDE ONLY
C   18) DE     ... MEAN-AXIAL PROJECTED CHORD AT 0.7 SPAN, FT.
C   19) RN     ... DIMENSIONLESS CENTROID FOR EQUIVALENT POINT LOAD,REF.2
C   20) LLF    ... LOADING-LAW INDICATOR, REF.2
C   21) S      ... LIFT-CURVE SLOPE, REF.2
C   22) XC     ... CONSTANT, C, IN LOADING LAW. REF.2
C   23) XM     ... CONSTANT, M, IN LOADING LAW. REF.2
C   24) XLC    ... CONSTANT, LC, IN LOADING LAW. REF.2
C   25) MO     ... AIRCRAFT MACH NUMBER
C   26) GRAD   ... CLIMB GRADIENT
C   27) DELTA  ... ANGLE IN DEGREES BETWEEN THRUST VECTOR AND HORIZON.
C   28) PSO    ... STATIC PRESSURE, PSIA
C   29) TSO    ... STATIC TEMPERATURE, DEG.R
C   30) AO     ... SPEED OF SOUND, FPS.
C   31) ITR    ... INDICATOR TO SPECIFY IF THE ROTOR BEING CONSIDERED IS
```

```
C                     MAIN ROTOR OR TAIL ROTOR. IT EQUALS ZERO FOR MAIN ROTO
C                     IS NON-ZERO FOR THE TAIL ROTOR.
C
C  OUTPUT
C    1) SPL    ... SOUND PRESSURE LEVEL SPECTRA IN DB RE. 20 MICRO-N/SQ.M
C                     AT FREE-FIELD, INDEX (R = 1 M) CONDITIONS.
C    2) PSI    ... DIRECTIVITY ANGLES CORRESPONDING TO EACH SPECTRUM.
C    3) IEC    ... ERROR CODE (PRESENTLY THIS IS A LOCAL VARIABLE)
C                     IEC = 0, NO ERRORS DETECTED
C                     IEC = 1, FOR HELICAL-TIP-MACH NUMBER .GT. 0.93
C                     IEC = 2, FOR (ME*SIN(PSI)/SF) .GT. 1)
C                     IEC = 3, FOR BAD INPUTS
C
C  REFERENCE
C    1) D.G. DUNN,/MASTER FLOW CHART FOR NASA CONTRACT NAS 2-6969
C       (PHASE B) COMPUTING REQUIREMENTS/, BOEING C/S ANS-RES-F-336,
C       6 DEC 1972.
C    2) D.G. DUNN,/NOISE PREDICTION FOR HELICOPTERS, TILT-ROTOR, AND
C       PROPELLER AIRCRAFT/, BOEING C/S ANS-RES-F-415, AUGUST 1973
C
      DIMENSION        G(24), BES(130), JD(8), XJD(8), DLJ(8), KM(4)
      DATA P5,R0,R1,R2,R5,R10,RPD,PI,SC,RC,A1,EPS/.5,0.,1.,2.,5.,10.,
     * 1.745329E-2,3.141593,5.0,3.280833,30.35438,1.E-5/
      DATA I1,I2,JD /1,2,1,2,3,5,7,10,15,21/
      DATA XJD /0.,.30103,.4771212,.69897,.845098,1.,1.176091,1.322219/
C
C  CONSTANTS KM = PI/60, 1.+ COS(70 DEG)**2, 4*PI, 10.**.57
      DATA KM /5.235988E-2,.21698,12.56637,3.715352/
C
      ICN(11)  =  ICN(11) + I1
      NANG  =  17
      NROT  =  NENG
      ROTN  =  NROT
C  ERROR CHECK OF INPUT ARGUMENTS
      IEC  =  3
      IF ((T .LE. R0) .OR. (Q .LE. R0) .OR. (THETA .LE. R0) .OR.
    1 (ROTN .LT. R1) .OR. (NBL .LT. R2) .OR. (NBL .GT. 6.) .OR.
    2 (DT .LE. R0) .OR. (AB .LE. R0) .OR. (DE .LE. R0) .OR.
    3 (RN .LE. R0) .OR. (RN .GT. R1) .OR. (LLF .LT. I1) .OR.
    4 (LLF .GT. 6) .OR. (S .LE. R0) .OR. (XC .LE. R0) .OR. (XM .LE. R0)
    5 .OR. (MO .LT. R0) .OR. (MO .GE. R1) .OR. (PSO .LE. R0) .OR.
    6 (TSO .LE. R0) .OR. (AO .LE. R0)) GO TO 135
      DO  200  I = 1,NANG
      IF  (SF(I) .LE. R0)  GO TO 135
  200 CONTINUE
      XX =  R0
      N  =  NFB + I1
      DO  210  I = 1,N
      IF  (F(I) .LE.XX)  GO TO 135
  210 XX =  F(I)
C
C  INITIALIZATION
      IF  (ITR)  211, 213, 211
  211 ALFA  =  1.570796
      DO  212  I = 1,NANG
      DO  212  J = 1,NOBS
      PSI(I,J)  =  ACOS(X(J) / P(J,I)) * 57.29578
```

```
  212 CONTINUE
      GO TO 214
  213 AN  =  DELTA * RPD
      ALFA  =  AN - ATAN(GRAD)
      CALL ANGLES(NUBS, AN)
  214 VT  =  KM(1) * THETA * DT
      MT  =  VT / AO
      MOX  =  MO * COS(ALFA)
      SMOX  =  MOX*MOX
      XX  =  MT*MT + MO*MO
      YY  =  MT*MO * SIN(ALFA)
      MTE  =  (XX * (XX*XX + 6.*YY*YY))**.1666667
      IF ((MTE .LE. RC) .OR. (MTE .GT. 0.93))  GO TO 130
      A  =  R1 + MTE
      B  =  R1 - MTE
      C  =  R2 * ALOG(A / B)
      VTE  =  AO * MTE
      R  =  P5 * RN * DT
      HC  =  Q / (T * R)
      ME  =  RN * MT
      XX  =  ME*ME + MO*MO
      YY  =  ME * YY / MT
      ME  =  (XX * (XX*XX + 6.*YY*YY))**.1666667
      VOX  =  AO * MOX
      SVOX  =  VOX*VOX
      V  =  0.7 * VT
      XX  =  V*V + (AO*MO)**2
      YY  =  V * YY / (RN * MT)
      V  =  (XX * (XX*XX + 6.*YY*YY))**.1666667
    1 CS  =  R1
      TMPI  =  R5
      GO TO (10, 2, 3, 4, 5, 6), LLF
    2 SDT  =  DT*DT
      VI  =  P5 * (VOX + SQRT(SVOX + A1 * TSO * T / (PSO * SDT)))
      SIG  =  1.2732395 * AO / SDT
      XM  =  1.3 + 0.4876 * (VI * SC / (S * SIG * VT))
      TMPI  =  R1 + XM*XM
      GO TO 10
    3 CS  =  0.7396
      TMPI  =  3.86
      GO TO 10
    4 CS  =  1936.
      HC  =  36.
      GO TO 10
    5 CS  =  595.36
      HC  =  30.
      GO TO 10
    6 CS  =  XC*XC
      TMPI  =  R1 + XM*XM
      HC  =  XLC
   10 CONTINUE
      FVT  =  0.28 * V / DE
      FCT  =  NBL * THETA / 60.
      UVT  =  VTE * T
      UVT  =  UVT*UVT / (AB * KM(2))
      URT  =  ME * T / (KM(3) * RG * R)
      HCT  =  HD / ME
```

```
      IEC  =  0
C
C  LOOP FOR EACH OBSERVER POSITION
      DO  115  JJ = 1,NOBS
      CALL LINCOR(COB(1,1),0,D,D,D,D,D,D,0,D,0,PSI(1,JJ),NFB,BCF,
     *            D,D,D,D,D,D,D,ICCR,IB(1,1,ITYPE),0,D)
C
C  LOOP FOR EACH ANGULAR POSITION RELATIVE TO FLT. PATH
      DO  110  II = 1,NANG
      FV  =  FVT / SF(II)
      FO  =  FOT / SF(II)
      UV  =  UVT / SF(II)
      UR  =  URT / (SF(II)*SF(II))
      HO  =  HOT * SF(II)
C
C  CALCULATE VORTEX NOISE PRESSURE SPECTRUM SHAPE.
      S1  =  F(1) / FV
      DO  15  K = 1,NFB
      S2  =  F(K+1) / FV
      AS1  =  A * S1
      BS1  =  B * S1
      AS2  =  A * S2
      BS2  =  B * S2
      G(K)  =  ALOG(((R1 + AS2*AS2) / (R1 + BS2*BS2)) * (R1 + BS1*BS1)
     * / (R1 + AS1*AS1)) / C
   15 S1  =  S2
      XX  =  PSI(II,JJ) * RPD
      CPSI  =  COS(XX)
      SPSI  =  SQRT(R1 - CPSI*CPSI)
C
C  FINISH-UP VORTEX NOISE PRESSURE SPECTRUM CALCULATION
      POA  =  KM(4) * UV * (0.1 + CPSI*CPSI)
      DO  20  K = 1,NFB
      PS(K)  =  POA * G(K)
   20 CONTINUE
C
C  ROTATIONAL NOISE CALCULATION
      QQ  =  ME * SPSI / SF(II)
      IF  (QQ .LE. R1)  GO TO 40
      DO  30  K = 1,NFB
      SPL(K,II)      =  RC
   30 CONTINUE
      IEC  =  I2
      CALL ERROR(ITYPE, 3, 16)
      GO TO 110
C
C  FORM HARMONIC LEVEL DATA CURVE
   40 DO  60  K = 1,8
      N  =  JD(K) * IFIX(NBL+P5)
      NP1  =  N + I1
      FN  =  N
      XX =  FN * QQ
      L1  =  FN - XX- P5
      L1  =  MAX0(L1, I1)
      LN  =  FN + XX+ P5
C
C  CALCULATE BESSEL FUNCTIONS
```

```
      CALL JBES(XX,NP1, EPS, BES)
C
C   SUM LOADING HARMONIC NOISE COMPONENTS
      AN  =  (CPSI - HO) * BES(NP1)
      AN  =  AN+AN
      DLJ(K)  =  AN * AN
      DO  50  L = L1,LN
      FL  =  L
      NML  =  N - L
      J  =  IABS(NML) + I1
      AN  =  (CPSI - HO * FLOAT(NML) / FN) * BES(J)
      HN  =  AN*AN * CS * FL**(-TMPI)
      IF  (LLF .GT. 3)  HN  =  HN / (R1 + (HC/FL)*(HC/FL))
   50 DLJ(K)  =  DLJ(K) + HN
      FL  =  UR * FLOAT(JD(K))
      DLJ(K)  =  124.57 + R10 * ALOG10(DLJ(K) * FL*FL)
   60 CONTINUE
C
C   NOW THAT DATA CURVE IS FORMED, ADD TONES TO VORTEX NOISE SPECTRUM.
      N1  =  R1 + F(1) / FO
      DO  105  I = 1,NFB
      N2  =  F(I+1) / FO
      IF  (N2 - N1)  90, 70, 70
   70 DO  80  J = N1,N2
      XJ  =  ALOG10(FLOAT(J))
      PS(I)  =  PS(I) + R10**(.1 * TBLU1(XJ, XJD, DLJ, 1, 8))
   80 CONTINUE
   90 XJ  =  PS(I) * RCTN
      IF  (XJ)  100, 100, 95
   95 SPL(I,II)  =  R10 * ALOG10(XJ) - CDB(I,II)
      TSPL(I,JJ,II)  =  PWRSUM(TSPL(I,JJ,II), SPL(I,II))
      GO TO 105
  100 SPL(I,II)  =  -CDB(I,II)
  105 N1  =  N2 + I1
  110 BETA(II,JJ)  =  INDEF
      IF  (IPRT(7) .NE. 7)  GO TO 106
      CALL NOISO(IPRT(7),JJ,NK,10,CHIN,IUNIT,CX(JJ),PFREQ,SPL(1,1),NFB,
     *          ITYPE)
  106 CONTINUE
      DO  107  J = 1,NANG
      DO  107  I = 1,NFB
  107 SPL(I,J)  =  SPL(I,J) - XDB(I,JJ,J)
      IF  (IPRT(3) .NE. 3)  GO TO 115
      CALL PNLSUB(SPL(1,1),PNL(1,JJ),TFD(1,JJ),EPNL(1,JJ),SPL2,
     *          TEPNL(1,JJ),NK,BCG,TCG,FLR,JJ,NOBS,IRR(JJ,1))
      CALL NOISO(IPRT(3),JJ,NK,12,CHIN,IUNIT,CX(JJ),PFREQ,SPL(1,1),NFB,
     *          ITYPE)
  115 CONTINUE
  120 RETURN
  130 IEC  =  I1
  135 CALL ERROR(ITYPE,3,8)
      GO TO 120
      END
```

```
      SUBROUTINE COREN                                                  COREN
C                                                                       COREN
      COMMON /COREIN/ TT3,PP3,CMF3,EK3,DELT3,JB3,                       COREN
     * ICOR3,LIN3,NTF3,IMA3,LGM3,NWL3,ICP3,ILAY3,TF3(10),               COREN
     * PCTA3(10),PLA3(10),ELCH3,EDH3,RIW3(10),TL3(10),CF3,FM3           COREN
      COMMON/TURBIN/BN3,SS3,VTR3,CLS3,CT3,TU3,PMF3,CS3,IC3,ISW3         COREN
C                                                                       COREN
C     VARIABLE SET CALCULATED IN THE PROGRAM PROCESSING                 COREN
C                                                                       COREN
      COMMON /GCOMON/ NCF,NK,BCF(24),TSPL(24,10,17),SPLT(24,17),        COREN
     *BUF(25),RETA(17),SPL2(17),TGAGR(24),DOPSF(17)                     COREN
C                                                                       COREN
C     GENERAL INPUT PARAMETERS                                          COREN
C                                                                       COREN
      COMMON /GPRAM/ALTP,ALTR,SLOPE,AMACH,NOBS,SLDIST(10),NTENG,IUNIT   COREN
     *    ,ISPTRM,IATMOS,IAIR,LAIRAB(24),NTEMP,TEMP(50),TALT(50)        COREN
     *    ,NPRES,PRES(50),PALT(50),NHUMID,RALT(50),RHUMID(50),CTEMP     COREN
     *    ,CPRES,CRHUMD,IEGA,IGOR,DTEMP,DPRES,DHUMIC,XKN,NC,FLD(50),    COREN
     * ZNR(50),ZNI(50),LINECT,MAXLIN,IPAGE,BCG,TCG,FLR,AALT,EPF         COREN
C                                                                       COREN
C     AIRCRAFT-OBSERVER GEOMETRY OUTPUTS                                COREN
C                                                                       COREN
      COMMON /GEOMO/ APY(10,17),APZ(10,17),PD(10,17),DPND(10,17),       COREN
     * B1(10,17),B2(10,17),TDS(17,10),TPD(17,10),IRR(10,17)             COREN
     *,APP,TP,RHP,APO,TO,RHO,CA,CZ,TSP(17,10),LCV                       COREN
C                                                                       COREN
C                                                                       COREN
      COMMON/SWITCH/NTYPE,ITYPE,NENG,ICCP,IPRT(7),ICN(13),NLCPT         COREN
     *,INSEOW(3),INSHLD                                                 COREN
      COMMON/SUMSPL/SSPL(24,10,17)                                      COREN
      COMMON/PNLD/PSPL(17,20),EPNL(5,10),TEPNL(5,10)                    COREN
      COMMON/ANGLE/PSI(17,10),PSIO(17,10),BETA(17,10)                   COREN
      COMMON/HEAD/HIN(20),HOUT(20),CHIN(20)                             COREN
      COMMON/GFREQ/CFREQ(24),LFREQ(25),PFREQ(24)                        COREN
      COMMON/GCONVC/C(2,10),SLDISX(10)                                  COREN
      COMMON/TMSPL/SPZ(24,17),IB(2,3,13)                                COREN
      COMMON/UNSHLD/USPLA(19),FSI(19),NUSPL,INUSP                       COREN
      COMMON/CRSPLS/DDB(17),PSCR(17),DFB(408),NPSCR                     COREN
      DIMENSION PS3(13),F3(13),SNI(24),F2SN(24)                         COREN
      DIMENSION FI1(8),FD1(8),FI2(8),FD2(8),TB1(24),TB2(8)              COREN
      DIMENSION TT3(1)                                                  COREN
      DATA V03/1./,RM3/1./,CC3/1116./                                   COREN
      DATA FD1/-21.,-13.,-4.,-1.5,0.,-1.5,-9.,-19./                     COREN
      DATA FI1/40.,60.,90.,100.,110.,120.,140.,160./                    COREN
      DATA FD2/-28.,-22.,-6.,-2.5,0.,-2.5,-8.,-20./                     COREN
      DATA FI2/40.,50.,90.,100.,110.,120.,130.,160./                    COREN
      DATA TB1/7*0.,5*.1,2*.2,.3,.4,.5,.6,.8,1.2,1.4,2.,2.9,4.2/        COREN
      DATA TB2/3*0.,.1,.2,.5,1.2,2.2/                                   COREN
      DATA RPD/1.745329E-2/,DPR/57.29578/                               COREN
      DATA PS3/40.,50.,60.,70.,80.,90.,100.,110.,120.,                  COREN
     *   130.,140.,150.,160./                                           COREN
      DATA F3/-7.7,-6.2,-5.3,-4.5,-3.4,-2.0,-0.9,0.,.2,.3,.1,-.1,-.2/   COREN
      DATA SNI/-2.0,-1.699,-1.5229,-1.3979,-1.30103,-1.2218,-1.1549,    COREN
     1         -1.0706,-1.0,-0.82391,-0.69897,-0.52288,-0.39794,        COREN
     2         -0.30103,-0.22185,-0.1549,-0.07058,0.0,0.17609,0.30103,  COREN
     3         0.47712,0.60206,0.69897,2.30103/                         COREN
      DATA F2SN/-38.2,-29.7,-24.7,-21.1,-18.4,-16.3,-14.7,-12.5,-11.0,  COREN
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```
     1          -7.8,-6.3,-5.3,-5.2,-5.5,-5.8,-6.2,-6.8,-7.3,-9.2,-10.8,
     2          -13.3,-15.3,-16.9,-45.C /
      ICN(3)=ICN(3)+1
      CLS=CLS3
      VTR=VTR3
      IF(ISW3 .EQ. 2)FBPF=555./SQRT(CMF3)
      IF(ISW3 .EQ.3)FBPF=BN3*SS3/6C.C
      IF((ISW3 .NE. 2) .AND. (ISW3 .NE. 3))FBPF=SQRT(9.25*BN3*SS3/
     *     SQRT(CMF3))
      DELTX=DELT3*RPD
      CALL ANGLES(NOBS,DELTX)
      XENG=NENG
      AJ=21.7
      IF(JB3.EQ.2) AJ=3C.7
C
C     TEST FOR SHIELDING AND EXIT TC PRINT CUT WING
C     SHIELDING DATA ONCE FCR ALL SIDELINE POSITICNS
C
      IF(INSHLD.NE.O)CALL WSHOLT(IPRT(7),10,ITYPE,USPLA,NUSPL,FSI,INUSP)
      DO  3CCO I=1,NOBS
      CALL LINCOR(SPZ(1,1),IMA3,LGM3,ELCH3,EDH3,NWL3,R1W3,
     *  TL3,ILAY3,FM3,IDP3,PSI(1,I),NCF,BCF,PLA3,CF3,PCTA3,
     *  NTF3,TF3,DOPSF,SPL2,ICOR3,IB(1,1,ITYPE),LIN3,FBPF)
      IF(ISW3.EQ.2)GO TO 95C
      IF(VTR3.EQ.O.)VTR=.7*3.1415926*SS3*DT3/60.
      IF(CLS3.EQ.O.)CLS=48.5*SQRT(TL3)
      DO 10 J=1,17
 1C   SPL2(J)=BN3*SS3/(6C.*DOPSF(J))
      XNCF=NCF
      W=10./XNCF*ALOG1C(BLF(NCF+1)/BLF(1))
      DO 9CO J=1,17
      TEMP1=10.*ALCG10((VTR*CC3/(VC3*CLS))**3*PMF3/RM3*
     *   W/DOPSF(J)**4)
     *   + TBLU1(PSI(J,I),FI1,FD1,1,8)-1C.
      DC 100 N=1,NCF
      BSPL=ALOG1C(BLF(N)/SPL2(J))
      TEMX=BSPL
      BSPL=TEMP1-20.*TEMX
      IF(TEMX.LT.O.)BSPL=TEMP1+10.*TEMX
      TGAGR(N)=1C.**(.1*BSPL)
  100 CCNTINUE
C
      TEMP2=10.*ALCG1C((VTR/VC3)**.6*(CO3/CLS)**3*(PMF3
     *   /RM3)*CS3/DOPSF(J)**4)
     *   + TBLU1(PSI(J,I),FI2,FD2,1,8) + 56.
      XK3=0.
      IF(IC3.NE.O)XK3=-1C.
      TEMP2=TEMP2+XK3
      C3=.1*TEMP2+1.
  125 CCNTINUE
      ESN=ESHLDG(PSIO(J,I),BETA(J,I),XENG)
      N1=1.+BUF(1)/SPL2(J)
      DO 20C N=1,NCF
      N2=BUF(N+1)/SPL2(J)
      IF((N2-N1).LT.O)GO TC 175
      IF(N1.GT.10)GO TO 175
      DC 150 K=N1,N2
```

```
      XK=K                                                              COREN
 150  TGAGR(N)=TGAGR(N)+10.**(C3-XK)                                    COREN
 175  SPLT(N,J)=TGAGR(N)                                                COREN
      IF(SPLT(N,J).LE.0.)GO TO 176                                      COREN
      SPLT(N,J)=10.*ALOG10(SPLT(N,J))                                   COREN
  176 N1=N2+1                                                           COREN
  180 CONTINUE                                                          COREN
      IF(NCF.EQ.24)GO TO 190                                            COREN
      DB=TB2(N)                                                         COREN
      GO TO 195                                                         COREN
 190  DB=TB1(N)                                                         COREN
  195 SPLT(N,J)=SPLT(N,J)+DB+33.2-ESN-SPZ(N,J)                          COREN
 200  CONTINUE                                                          COREN
 900  CONTINUE                                                          COREN
C                                                                       COREN
      IF(INSHLD.NE.0.AND.ISW3.EQ.3)CALL SHLDSP(AMACH,ALTR,ISPTRM,CZ,    COREN
     *SLDIST,I,APY,APZ,DOPSF,SPLT,NCF,BCF,SPZ,PSI,ITYPE,DELT3,ISW3)     COREN
C                                                                       COREN
      IF(ISW3.EQ.3)GO TO 2010                                           COREN
C                                                                       COREN
 950  CONTINUE                                                          COREN
C                                                                       COREN
      DO  2000 J=1,17                                                   COREN
      ESN=ESHLDG(PSIO(J,I),BETA(J,I),XENG)                              COREN
      F1PSI=TBLU1(PSI(J,I),PS3,F3,1,13)                                 COREN
      OA = 10.*ALOG10(CMF3*TT3(1)*TT3(1) * PP3**3 / (DOPSF(J)*DOPSF(J))) COREN
     1         + F1PSI + AJ + EK3                                       COREN
      SNTZ=1850./(DOPSF(J)*SQRT(CMF3))                                  COREN
 975  CONTINUE                                                          COREN
      DO 1000  K=1,NCF                                                  COREN
      SNT=BCF(K)/SNTZ                                                   COREN
      SNL=ALOG10(SNT)                                                   COREN
      F2SNI=TBLU1(SNL,SNI,F2SN,1,24)                                    COREN
      IF(NK.EQ.3) F2SNI=F2SNI-4.8                                       COREN
      TEMPXX=SPLT(K,J)                                                  COREN
C                                                                       COREN
      SPLT(K,J)=OA+F2SNI-ESN-SPZ(K,J)                                   COREN
      IF(ISW3.EQ.2)GO TO 980                                            COREN
      SPLT(K,J)=PWRSUM(SPLT(K,J),TEMPXX)                                COREN
 980  CONTINUE                                                          COREN
 1000 CONTINUE                                                          COREN
 2000 CONTINUE                                                          COREN
C                                                                       COREN
      IF(INSHLD.NE.0)               CALL SHLDSP(AMACH,ALTR,ISPTRM,CZ,   COREN
     *SLDIST,I,APY,APZ,DOPSF,SPLT,NCF,BCF,SPZ,PSI,ITYPE,DELT3,ISW3)     COREN
C                                                                       COREN
 2010 DO 2050 J=1,17                                                    COREN
      DO 2050 K=1,NCF                                                   COREN
 2050 SSPL(K,I,J)=PWRSUM(SSPL(K,I,J),SPLT(K,J))                         COREN
C                                                                       COREN
 2100 IF(IPRT(7).NE.7)GO TO 2200                                        COREN
      CALL NOISO(IPRT(7),I,NK,10,CHIN,ILNIT,SLDISX(I),PFREQ,            COREN
     1    SPLT(1,1),NCF,ITYPE)                                          COREN
 2200 CONTINUE                                                          COREN
      DO 2500  K=1,NCF                                                  COREN
      DO 2500  J=1,17                                                   COREN
 2500 SPLT(K,J)=SPLT(K,J)-TSPL(K,I,J)                                   COREN
```

```
      IF(IPRT(3).NE.3)GO TO 3000
      CALL  PNLSUB(SPLT(1,1),PSPL(1,I),TPD(1,I),EPNL(1,I),SPL2,
     *     TEPNL(1,I),NK,BCG,TCG,FLR, I,NOBS,IRR(I,1))
      CALL NOISO(IPRT(3),I,NK,12,CHIN,IUNIT,SLCISX(I),
     1   PFREQ,SPLT(1,1),NCF,ITYPE)
 3000 CONTINUE
      RETURN
      END
```

```
      SUBROUTINE CORSPL(ICOR,IB,NB,PA,SP)                               CORSPL
C                                                                       CORSPL
      COMMON /GCOMON/ NCF,NK,BCF(24),TSPL(24,10,17),SPLT(24,17),        CORSPL
     *BUF(25),RETA(17),SPL2(17),TGASR(24),DOPSF(17)                     CORSPL
      COMMON/ICPATH/NCAS,NCOF,NTYP,IC,NRN,IARRAY(2)                     CORSPL
      COMMON/CRSPLS/DO(17),PS(17),DP(408),NPSCR                         CORSPL
      COMMON/SWITCH/NTYPE,ITYPE                                         CORSPL
C                                                                       CORSPL
C         THIS ROUTINE ALLOWS DB  CORRECTION TABLES TO BE PLACED ON FILE CORSPL
C         UPDATED PER CASE PER CONFIGURATION PER NOISE COMPONENT        CORSPL
C                                                                       CORSPL
C      INPUTS                                                           CORSPL
C                                                                       CORSPL
C         ICOR =1  17 VALUE TABLE IS BUILT FOR A SINGLE DB  CORRECTION P CORSPL
C                  ANGLE FOR ALL BANDS                                  CORSPL
C              =2  24,NPSCR  OR  8,NPSCR TABLE OF  DB CORRECTIONS TO ALL CORSPL
C                  FOR BOTH DIRECTIVITY AND SOUND LEVEL CHANGES         CORSPL
C         NB        NUMBER OF FREQUENCY BANDS  24 OR 8                  CORSPL
C         PA(1-17)   17 DIRECTIVITY ANGLES                              CORSPL
C                                                                       CORSPL
C       OUTPUT                                                          CORSPL
C                                                                       CORSPL
C         SP(24,17) ARRAY OF DB CORRECTIONS                             CORSPL
      DIMENSION IB(2,3),DBT(24,17),DCT(17),PST(17),SP(24,17),PA(17)     CORSPL
      DIMENSION RBUX(10)                                                CORSPL
      DIMENSION RBUF(14)                                                CORSPL
      DIMENSION DSPL(24),DBN(17),BN(24)                                 CORSPL
C360  REAL*8 FNAM                                                       CORSPL
C                                                                       CORSPL
C MASS STORAGE (RANDOM DISK I/O) INDECES, COUNTER, AND FLAG             CORSPL
      COMMON /MSIO/ INDX1(40), INDX2(3), INDX3(36), IC1, ICPEN          CORSPL
      DATA IL1, IL2, IL3, IRR /40, 3, 36, C/                            CORSPL
      DATA ET/1.2E-3/                                                   CORSPL
      DATA IOP/0/                                                       CORSPL
      IRP=1                                                             CORSPL
      IGO=1                                                             CORSPL
      IF(IOP.NE.0)GO TO 1                                               CORSPL
      W=1.                                                              CORSPL
      IF(NB.EQ.24)W=.3333                                               CORSPL
      DO 1000 J=1,17                                                    CORSPL
 1000 DBN(J)=1.442695041*ALOG(DOPSF(J))/W                               CORSPL
      IOP=1                                                             CORSPL
      NRN=1                                                             CORSPL
      IC1  =  1                                                         CORSPL
C360  CALL GETPAR(FNAM,1)                                                CORSPL
C360  CALL DEFINE(13,FNAM,&SPLCOR  &,NRN,140)                            CORSPL
C                                                                       CORSPL
C OPEN RANDOM DISK FILE 13 AND SET FLAG, ICPEN, TO INDICATE THE FILE    CORSPL
C IS OPENED.                                                            CORSPL
      CALL OPENMS(13, INDX1, IL1, C)                                    CORSPL
      IOPEN  =  1                                                       CORSPL
C                                                                       CORSPL
C TURN-OFF FATAL READ ERROR 78 AND 79 SENSE SWITCHES AND TURN-ON        CORSPL
C ERROR COUNTER, IRR                                                    CORSPL
    1 CALL ERRSET(IRR, 1)                                               CORSPL
      IF(IB(1,NCOF).EQ.0)GO TO 5                                        CORSPL
      IR=IB(1,NCOF)                                                     CORSPL
```

```
      IGO=2
      IF  (IR-1)  20, 20, 50
C         BUILD CORRECTION TABLES
 5    CONTINUE
      IB(1,NCOF)=ICOR
C
C SAVE MAJOR INDEX COUNTER IN STORAGE PROVIDED BY NOISE COMP. ROUTINE
      IB(2,NCOF)  =  IC1
C
C IBM360
C360  IB(2,NCOF)  =  NRN
      IF  (ICOR-1)  10, 10, 40
 10   CONTINUE
C
C IBM360
C  14 NRN  =  IB(2,NCOF)
C360  WRITE(13,15)(DO(J),J=1,NPSCR)
C360  WRITE(13,15)(PS(J),J=1,NPSCR)
C
C INITIALIZE MINOR AND MAJOR INDEX COUNTERS
   14 NRN  =  1
      IC1  =  IB(2,NCOF)
      IF  (IGO .GT. 1)  GO TO 105
C
C ZERO OUT MINOR INDEX BEFORE WRITING ON DISK FOR 1ST TIME FOR THIS
C NOISE COMPONENT
   95 DO  100  J = 1,IL2
      INDX2(J)  =  0
  100 CONTINUE
C
C SET INDICATOR TO WRITE AT END-OF-INFORMATION
      IW  =  0
      GO TO 110
C
C SET INDICATOR TO WRITE IN-PLACE
  105 IW  =  1
C
C USE MINOR INDEX
  110 CALL STINDX(13, INDX2, IL2)
      ENCODE(140,15,RBUF)(DO(J),J=1,NPSCR)
 15   FORMAT(17F8.3,4X)
C
C WRITE DATA ON DISK
      CALL WRITMS(13, RBUF, 14, NRN, IW)
      NRN=NRN+1
      ENCODE(140,15,RBUF)(PS(J),J=1,NPSCR)
      CALL WRITMS(13, RBUF, 14, NRN, IW)
C
C USE MAJOR INDEX
      CALL STINDX(13, INDX1, IL1)
C
C WRITE MINOR INDECES ON DISK
      CALL WRITMS(13, INDX2, IL2, IC1, IW)
      IC1  =  IC1 + 1
      IF  (IGO-1)  20, 20, 30
   20 NRS  =  1
C
```

```
C READ MINOR INDECES FROM DISK
      CALL READMS(13, INDX2, IL2, IB(2,NCCF))
C
C USE MINOR INDEX
      CALL STINDX(13, INDX2, IL2)
C360  READ(13,15)(DOT(J),J=1,NPSCR)
C360  READ(13,15)(PST(J),J=1,NPSCR)
C
C READ DATA FROM DISK
      CALL READMS(13, RBUF, 14, NRS)
      DECODE(140,15,RBUF)(DOT(J),J=1,NPSCR)
      IF  (IRR .GT. 0)  GO TO 3000
      NRS=NRS+1
      CALL READMS(13, RBUF, 14, NRS)
C
C USE MAJOR INDEX
      CALL STINDX(13, INDX1, IL1)
      DECODE(140,15,RBUF)(PST(J),J=1,NPSCR)
      IF  (IRR .GT. 0)  GO TO 3000
      IF  (IGO-1)  30, 30, 25
 25   DO 29 J=1,NPSCR
      IF(DO(J).EQ.ET)GO TO 27
      IF(DO(J).EQ.DOT(J))GO TO 27
      DOT(J)=DO(J)
      IRP=2
 27   DO(J)=DOT(J)
      IF(PS(J).EQ.ET)GO TO 28
      IF(PS(J).EQ.PST(J))GO TO 28
      PST(J)=PS(J)
      IRP=2
 28   PS(J)=PST(J)
 29   CONTINUE
      IF  (IRP-1)  30, 30, 14
   30 CONTINUE
       DO 39 J=1,17
      TSPX=TBLU1(PA(J),PST,DOT,1,NPSCR)
      DO 38 N=1,NB
      SP(N,J)=SP(N,J)+TSPX
 38   CONTINUE
 39   CONTINUE
      GO TO 4000
 40   IGO=1
C
C IBM360
C  42 NRN  =  IB(2,NCCF)
   42 NRN  =  1
      IC1  =  IB(2,NCCF)
      NMI  =  NPSCR + 2
      IF  (NB .GT. 12)  NMI = NMI + NPSCR
      IF  (IGO .GT. 1)  GO TO 205
  195 DO  200  J = 1,NMI
      INDX3(J)  =  0
  200 CONTINUE
      IW  =  0
      GO TO 210
  205 IW  =  1
  210 CALL STINDX(13, INDX3, NMI)
```

```
      NS=1-NB                                                           CORSPL
      N2=NS                                                             CORSPL
      DO 45 J=1,NPSCR                                                   CORSPL
      NS=NS+NB                                                          CORSPL
      NE=NS-N2                                                          CORSPL
      IF  (NB .GT. 12)  GO TO 43                                        CORSPL
C360  WRITE(13,17)(DP(N),N=NS,NE)                                       CORSPL
C  17 FORMAT(24F8.3,8X)                                                 CORSPL
      ENCODE(100,16,RBUX)(DP(N),N=NS,NE)                                CORSPL
 16   FORMAT(12F8.3,4X)                                                 CORSPL
      CALL WRITMS(13, RBUX, 10, NRN, IW)                                CORSPL
      NRN=NRN+1                                                         CORSPL
      GO TO 45                                                          CORSPL
 43   NM=NS+11                                                          CORSPL
      NF=NM+1                                                           CORSPL
      ENCODE(100,16,RBUX)(DP(N),N=NS,NM)                                CORSPL
      CALL WRITMS(13, RBUX, 10, NRN, IW)                                CORSPL
      NRN=NRN+1                                                         CORSPL
      ENCODE(100,16,RBUX)(DP(N),N=NF,NE)                                CORSPL
      CALL WRITMS(13, RBUX, 10, NRN, IW)                                CORSPL
      NRN=NRN+1                                                         CORSPL
 45   CONTINUE                                                          CORSPL
C360  WRITE(13,15)(PS(J),J=1,NPSCR)                                      CORSPL
      ENCODE(140,15,RBUF)(PS(J),J=1,NPSCR)                              CORSPL
      CALL WRITMS(13, RBUF, 14, NRN, IW)                                CORSPL
      CALL STINDX(13, INDX1, IL1)                                       CORSPL
      CALL WRITMS(13, INDX3, NMI, IC1, IW)                              CORSPL
      IC1  =  IC1 + 1                                                   CORSPL
      IF  (IGO-1)  50, 50, 70                                           CORSPL
   50 NRS  =  1                                                         CORSPL
      CALL READMS(13, INDX3, NMI, IB(2,NCOF))                           CORSPL
      CALL STINDX(13, INDX3, NMI)                                       CORSPL
      DO 55 J=1,NPSCR                                                   CORSPL
      IF(NB.EQ.24)GO TO 53                                              CORSPL
C360  READ(13,17)(DBT(N,J),N=1,NB)                                       CORSPL
      CALL READMS(13, RBUX, 10, NRS)                                    CORSPL
      DECODE(100,16,RBUX)(DBT(N,J),N=1,NB)                              CORSPL
      IF  (IRR .GT. 0)  GO TO 3000                                      CORSPL
      NRS=NRS+1                                                         CORSPL
      GO TO 54                                                          CORSPL
 53   CONTINUE                                                          CORSPL
      CALL READMS(13, RBUX, 10, NRS)                                    CORSPL
      DECODE(100,16,RBUX)(DBT(N,J),N=1,12)                              CORSPL
      IF  (IRR .GT. 0)  GO TO 3000                                      CORSPL
      NRS=NRS+1                                                         CORSPL
      CALL READMS(13, RBUX, 10, NRS)                                    CORSPL
      DECODE(100,16,RBUX)(DBT(N,J),N=13,24)                             CORSPL
      IF  (IRR .GT. 0)  GO TO 3000                                      CORSPL
      NRS=NRS+1                                                         CORSPL
 54   CONTINUE                                                          CORSPL
 55   CONTINUE                                                          CORSPL
C360  READ(13,15)(PST(J),J=1,NPSCR)                                      CORSPL
      CALL READMS(13, RBUF, 14, NRS)                                    CORSPL
      CALL STINDX(13, INDX1, IL1)                                       CORSPL
      DECODE(140,15,RBUF)(PST(J),J=1,NPSCR)                             CORSPL
      IF  (IRR .GT. 0)  GO TO 3000                                      CORSPL
      IF  (IGO-1)  70, 70, 60                                           CORSPL
```

```
 60   CONTINUE                                                                 CORSPL
      DO 64 J=1,NPSCR                                                          CORSPL
      DO 62 N=1,NB                                                             CORSPL
      I=(J-1)*NB+N                                                             CORSPL
      IF(DP(I).EQ.ET)GO TO 61                                                  CORSPL
      IF(DBT(N,J).EQ.DP(I))GO TO 62                                            CORSPL
      DBT(N,J)=DP(I)                                                           CORSPL
      IRP=2                                                                    CORSPL
 61   DP(I)=DBT(N,J)                                                           CORSPL
 62   CONTINUE                                                                 CORSPL
      IF(PS(J).EQ.ET)GO TO 63                                                  CORSPL
      IF(PS(J).EQ.PST(J))GO TO 64                                              CORSPL
      PST(J)=PS(J)                                                             CORSPL
      IRP=2                                                                    CORSPL
 63   PS(J)=PST(J)                                                             CORSPL
 64   CONTINUE                                                                 CORSPL
      IF  (IRP-1)  70, 70, 42                                                  CORSPL
 70   CONTINUE                                                                 CORSPL
      DO   90   J=1,17                                                         CORSPL
      DO   75   N=1,NB                                                         CORSPL
      DSPL(N)= TBLU2(BCF(N),PA(J),BCF,FST,DBT,1,1,NB,NPSCR,24,17)              CORSPL
      DBFC=DBN(J)                                                              CORSPL
      IF(ITYPE.EQ.1.OR.ITYPE.EQ.2.OR.ITYPE.EQ.6.OR.ITYPE.EQ.9.OR.ITYPE.        CORSPL
     *  EQ.12)DBFC=0.                                                          CORSPL
 75   BN(N)=FLOAT(N)-DBFC                                                      CORSPL
      DO   80   N=1,NB                                                         CORSPL
 80   SP(N,J)=SP(N,J)+TBLU1(FLOAT(N),BN,DSPL,1,NB)                             CORSPL
 90   CONTINUE                                                                 CORSPL
      GO TO 4000                                                               CORSPL
 3000 CALL ERROR(ITYPE,6,14)                                                   CORSPL
      STOP                                                                     CORSPL
C                                                                              CORSPL
C TURN-ON FATAL READ ERROR 78 AND 79 SENSE SWITCHES                            CORSPL
 4000 CALL ERRSET(IKK, 0)                                                      CORSPL
      DO 4100 J=1,17                                                           CORSPL
      DC(J)=ET                                                                 CORSPL
 4100 PS(J)=ET                                                                 CORSPL
      DO 4200 N=1,408                                                          CORSPL
 4200 DP(N)=ET                                                                 CORSPL
      RETURN                                                                   CORSPL
      END                                                                      CORSPL
```

```
      COMPLEX FUNCTION CPOLAR(A)
C
C  COMPUTES THE POLAR FORM (MAGNITUDE, ANGLE) FOR THE COMPLEX QUANTITY
C  A, (REAL PART, IMAGINARY PART).
C
      COMPLEX A
      DATA PI2 / 1.57079632679494 /
      AMP(X, Y)  =  ABS(X) * SQRT(1. + (Y/X)*(Y/X))
      AR  =  REAL(A)
      AI  =  AIMAG(A)
      T  =  0.0
      IF  (AR)  20, 10, 20
   10 IF  (AI)  20, 50, 20
   20 T  =  ATAN2(AI, AR)
      J  =  ABS(T / PI2) + 0.5
      IF  (J - 2 * (J / 2))  30, 40, 30
   30 AR  =  AMP(AI, AR)
      GO TO 50
   40 AR  =  AMP(AR, AI)
   50 CPOLAR  =  CMPLX(AR, T)
      RETURN
      END
```

```
      SUBROUTINE DATAIN(N,DATN,N4,D1,D2,D3,D4,IMCDE)                    DATAIN
C                                                                       DATAIN
C     PURPOSE TO READ IN VARIABLES AND ARRAYS                           DATAIN
C        ANS    DUMMY VALUES OF ANL TO ELIMINATE BLOCK DATA REQUIRED BY 3 DATAIN
C          ALSO TO SORT AND REARANGE THE BASIC DATA FROM TEE187C        DATAIN
      COMMON/COUNT/NEPR,NL                                              DATAIN
      COMMON/DIGI/IUNIT,IPNDB,IPLCT                                     DATAIN
      COMMON/CONTNT/AEPR(5),ALRO(9),AALFA(6)                            DATAIN
      COMMON/SIZE/NLRC,NALFA                                            DATAIN
C                                                                       DATAIN
      COMMON/LEVELS/ANL( 5 )                                            DATAIN
      DIMENSION DATN(1)                                                 DATAIN
      DIMENSION ANS(5)                                                  DATAIN
      DIMENSION D1(1),D2(1),D3(1),D4(1)                                 DATAIN
      DIMENSICN ARG(324)                                                DATAIN
C   IBM SYS36C + 37C                                                    DATAIN
C     REAL*8 ARG                                                        DATAIN
C                                                                       DATAIN
C        DATA WILL BE LOADED BY DATA STATEMENTS TO CONSERVE TIME AND    DATAIN
C                                                                       DATAIN
C     READ THE SPECIFIC NOISE CL .CLR VALUES TC BE EXAMINED             DATAIN
C       AND THE NUMBER OF CONTOUR VALUES                                DATAIN
      NAMELIST/DIGINT/ANL,NL,IUNIT,IPNDB,IPLCT                          DATAIN
      DATA ANS/85.,90.,95.,100.,105./                                   DATAIN
C                                                                       DATAIN
      NL=5                                                              DATAIN
      DC  1000  I=1,NL                                                  DATAIN
 1000 ANL(I)=ANS(I)                                                     DATAIN
      IF(IMODE.EQ.-1)GO TO  1010                                        DATAIN
      IPNDB=0                                                           DATAIN
      IPLOT=0                                                           DATAIN
      IUNIT=0                                                           DATAIN
      READ(5,DIGINT)                                                    DATAIN
 1010 CONTINUE                                                          DATAIN
C                                                                       DATAIN
C                                                                       DATAIN
C                                                                       DATAIN
C     READ NUMBER OF NOISE FUNCTION VALUES TO BE READ                   DATAIN
C                                                                       DATAIN
C     READ THE ARRAYS OF NOISE LEVEL PARAMETERS NL=FUN(EPR.,ALPHA,LRO)  DATAIN
C        D1, D2, D3. D4                                                 DATAIN
C    DATN IS AN ARRAY SUPPLIED BY THE187 OF NOISE VALUES                DATAIN
C  EPR VALUES, ALPHA VALUES AND VALUES OF LOG10 RO IN A ONE DIMENSIONAL DATAIN
C    STRING SUCH THAT THE SETS REPEAT THEIR ORDER                       DATAIN
      J=0                                                               DATAIN
      DC  1020  I=1,N,4                                                 DATAIN
      J=J+1                                                             DATAIN
      D1(J)=DATN(I)                                                     DATAIN
      D2(J)=DATN(I+1)                                                   DATAIN
      D3(J)=DATN(I+2)                                                   DATAIN
      D4(J)=DATN(I+3)                                                   DATAIN
 1020 CONTINUE                                                          DATAIN
C       SORTS INTO INCREASING ORDER                                     DATAIN
C     SORT WITH RESPECT TO EPR                                          DATAIN
      CALL SORRTR(D2,D3,D4,N4,D1,DATN(N4+1),DATN(1),ARG)                DATAIN
C     GET THE NUMBER OF DISTINCT EPRES,ALPHAES ,LROES AND THEIR         DATAIN
C        VALUES AND STORE THEM                                          DATAIN
```

```
C                                                                       DATAIN
      CALL SQUASH (D2,N4,AEPR,NEPR)                                     DATAIN
      CALL SQUASH(D3,N4,AALFA,NALFA)                                    DATAIN
      CALL SQUASH(D4,N4,ALRO,NLRO)                                      DATAIN
C                                                                       DATAIN
C                                                                       DATAIN
C                                                                       DATAIN
C          OUTPUT SECTION FOR INPUT ACOUSTIC DATA                       DATAIN
C                                                                       DATAIN
C                                                                       DATAIN
      I2=0                                                              DATAIN
      DO  1040  I=1,NEPR                                                DATAIN
      IF  (MOD(I-1, 2))  9007, 9006, 9007                               DATAIN
 9006 WRITE (6,8999)                                                    DATAIN
 8999 FORMAT(1H1,//54X,22HACOUSTIC DATA FUNCTION,/53X,24HNOISE LEVEL VAL DATAIN
     *UES  (DB) )                                                       DATAIN
 9007 WRITE (6,9008) AEPR(I)                                            DATAIN
 9008 FORMAT(//10X,34HAT ENGINE PERFORMANCE PARAMETER = ,1PE10.3)       DATAIN
      WRITE(6, 9009 )                                                   DATAIN
 9009 FORMAT(/55X,24HLOG10 OF RANGE AT CPA    )                         DATAIN
      WRITE (6,9010)                                                    DATAIN
 9010 FORMAT(5X,10HELEVATION )                                          DATAIN
      WRITE (6,9011) (ALRO(J), J = 1,NLRO)                              DATAIN
 9011 FORMAT(7X,5HANGLE,5X,1PE12.3,8E12.3)                              DATAIN
 9012 FORMAT(5X,9H(DEGREES)     )                                       DATAIN
      DO  1030  N=1,NALFA                                               DATAIN
      I1=I2+1                                                           DATAIN
      I2=I1+NLRO-1                                                      DATAIN
      WRITE(6, 9013 ) AALFA(N),(D1(K),K=I1,I2)                          DATAIN
 9013 FORMAT(/4X,1PE10.3,2X,0PF10.1,8F12.1)                             DATAIN
 1030 CONTINUE                                                          DATAIN
 1040 CONTINUE                                                          DATAIN
C                                                                       DATAIN
C                                                                       DATAIN
      CALL SWITCH(NEPR, NL, NLRO, NALFA, D1, D2)                        DATAIN
C                                                                       DATAIN
C                                                                       DATAIN
C          OUTPUT SECTION FOR TRANSFORMED INPUT ARRAY                   DATAIN
C                                                                       DATAIN
C                                                                       DATAIN
      WRITE (6,9016)                                                    DATAIN
 9016 FORMAT(1H1,///)                                                   DATAIN
      WRITE(6, 9014 )                                                   DATAIN
 9014 FORMAT(40X,51HTABLE OF DEVELOPED VALUES FOR LOG10 OF RANGE AT CPA) DATAIN
      WRITE(6, 9015 )                                                   DATAIN
 9015 FORMAT(46X,43HBASED ON THE PRECEDING INPUT ACOUSTIC DATA       )  DATAIN
      I4=0                                                              DATAIN
      DO  1060  I=1,NL                                                  DATAIN
      WRITE(6, 9017 )ANL(I)                                             DATAIN
 9017 FORMAT(///,44X,26HVALUES FOR NOISE LEVEL OF   ,F5.1,5H  DB  )     DATAIN
      WRITE(6, 9018 )                                                   DATAIN
 9018 FORMAT(//, 7X,9HELEVATION,30X,28HENGINE PERFORMANCE PARAMETER    ) DATAIN
      WRITE(6, 9019 )                                                   DATAIN
 9019 FORMAT(9X,5HANGLE)                                                DATAIN
      WRITE(6, 9020 ) (AEPR(J),J=1,NEPR)                                DATAIN
 9020 FORMAT(7X,9H(DEGREES),2X,1PE15.3,5E15.3)                          DATAIN
      WRITE (6,9013)                                                    DATAIN
```

```
      DO  1050  K=1,NALFA
      I3=I4+1
      I4=I3+NEPR-1
      WRITE(6,9021) AALFA(K),(D2(L),L=I3,I4)
 9021 FORMAT(6X,1H(,1PE10.3,2H) ,4X,E10.3,(5E15.3))
 1050 CONTINUE
 1060 CONTINUE
C
C
      RETURN
      END
```

```
      FUNCTION DPSD(F,SBO,CBO,SB1,TA,SB1S,R,DRN,CO,KN,LDF,ZNR,ZNI,ND)
C
C  COMPUTES THE ACOUSTIC GROUND REFLECTION ANOMALY FOR POWER SPECTRAL
C  DENSITIES
C
      REAL KN, KOR, LF, LDF
      DIMENSION LDF(1),ZNR(1),ZNI(1)
      DIMENSION RPX(2), WX(2), Z(2)
      COMPLEX FW, W, RP, ZN, FX, DP, SB1, TA
      COMMON/BLK97/ZN,RP,W,FX
      EQUIVALENCE (RPX(1), RP), (WX(1), W), (Z(1), ZN)
      DATA ZERO, ONE, EPS, TPI /0.,1.,1.2E-5,6.2831853071796/
      TA  =  (0.,0.)
      DPSD  =  ONE
      TSBOS  =  ONE - KN*KN
      KOR  =  TPI * F * R / CO
      DA  =  KOR * DRN
      LF  =  ALOG10(F)
      Z(1)=  TBLU1(LF, LDF, ZNR, 2, ND)
      Z(2)=  TBLU1(LF, LDF, ZNI, 2, ND)
      IF ((ABS(Z(1))-ONE) .LE. EPS .AND. ABS(Z(2)) .LE. EPS)  GO TO 9
    1 RP  =  ZN * SBO + SB1
      IF  (ABS(RPX(1))+ABS(RPX(2)) - EPS)  2, 2, 4
    2 IF  (ABS(TSBOS) - EPS)  10, 10, 11
   10 RP  =  (ZN - ONE) / (ZN + ONE)
      GO TO 5
   11 RP  =  (-1.,0.)
      GO TO 5
    4 RP  =  (RP - (SB1+SB1)) / RP
    5 W  =  ZN * (ONE - RP) * CBO
      W  =  W * W
      IF  (ABS(WX(1))+ABS(WX(2)) - EPS) 6, 6, 7
    6 FX  =  (0.,0.)
      GO TO 8
    7 W  =  (0.,1.) * ((KOR+KOR)*SB1S) / W
      FX  =  FW(W)
    8 TA  =  (RP + FX * (ONE - RP)) / (ONE + DRN)
      DP  =  ONE + TA * CMPLX(COS(DA), -SIN(DA))
      DPSD  =  REAL(DP * CONJG(DP))
    9 RETURN
      END
```

```
      SUBROUTINE DRIVES(D1,D2,X1,X2,Y1,Y2,SUM,SLNL,IMODE)
C     PURPOSE  TO SIMULATE THE OUTPUT OF THE AMES FSAA SIMULATOR
C       BY GIVING COORDINATES OF THE FLIGHT PATH (Y,Z),THE ENGINE
C       PRESSURE RATIO(EPR),THE DIRECTIVITY ANGLE(SCI) AND THE ENGINE
C       ATTITUDE ANGLE(DE)
      COMMON/COUNT/NEPR,NL
      COMMON/DIGI/IUNIT,IPNDB,IPLOT
      COMMON/CONTNT/AEPR(6),ALRO(9),AALFA(6)
      COMMON/LEVELS/ANL(5)
      COMMON/ASD/SD(3),NSL
      COMMON/SIZE/NLRO,NALFA
      COMMON/FLIGHT/IMODEQ,DXQ,DYQ,DZQ,DSCIQ,DDEQ,DEPRQ
      COMMON/RESULT/X1Q,X2Q,Y1Q,Y2Q,SUMQ,SLNLQ,IECQ
      DIMENSION X1Q(5),X2Q(5),Y1Q(5),Y2Q(5),SUMQ(5),SLNLQ(3),IECQ(5)
      DIMENSION XP(1020),YP(1020),FS(306),FP(306)
      DIMENSION DX(100),DY(100),DZ(100),DEPR(100),DDE(100)
      DIMENSION S(20),DDX(20),DDY(20),DDZ(20),DDEPR(20),DDDE(20)
      DIMENSION D1(1),D2(1),TITLE(16)
      DIMENSION X1(5),X2(5),Y1(5),Y2(5)
      DIMENSION IEC(5),SUM(5),SDS(3),SLNL(3)
      DIMENSION PN(2),EM(2)
      DIMENSION SPP(100)
      DATA II,III/ 1,1/
      DATA EM /3HEPN, 3H PN/
      DATA PN/3H M.,3HFT./
      NAMELIST/DIGSIM/NFPP,DX,DY,DZ,DEPR,DDE,DSCI,SD,NSL
     1,ND,DS,DDX,DDY,DDZ,DDEPR,DDDE,NLS,NLF,ISTOP
C               INITIALIZE  THE  FLIGHT PATH VALUES
      DATA ND,S(1)/0,0.0/
      DATA NFPP,NLN/25,5/
      DATA DX/100*0.0/
      DATA DY/100.,200.,300.,400.,500.,600.,700.,800.,900.,1000.,1200.,
     11400.,1600.,1800.,2000.,2300.,2600.,3000.,4000., 5000.,6000.,7000.
     2,8000.,9000.,10000.,75*10000.0/
      DATA DZ/1.0,1.0,1.0,50.,100.,150.,200.,300.,400.,500.,600.,700.,
     1800.,900.,1000.,1200.,1400.,1800.,1900.,2000.,2100.,2200.,2300.,
     22400.,2500.,75*0.0/
      DATA DEPR/15*2.0,1.9,1.8,1.7,1.6,1.5,1.6,1.7,1.8,1.9,2.0,75*1.9/
      DATA DDE /10*20.0,5*15.0,5*10.0,5*0.0,75*0.0/
      DATA DSCI/110.0/
      DATA NSL1,SDS/3,1.0,152.4,463.3/
      DATA ISTOP/0/
C
C     PUSH FLIGHT PARAMETERS INTO SUBROUTINE VALUES
      IF (IMODE .EQ. -1) GO TO  1100
      NSL=NSL1
      NLS=1
      NLF=NL
      IF (IPNDB .EQ. 1) III=2
      IF (IUNIT .EQ. 1) II=2
      IC=0
      DO 999 I=1,NSL
  999 SD(I)=SDS(I)
 1000 CONTINUE
      READ(5, 9000 ) TITLE
      IC=IC+1
      READ(5,DIGSIM)
```

```
      NLN=NLF-NLS+1                                                     DRIVES
      IF(IC.EQ.1)GO TO  1010                                            DRIVES
      CALL RESTRT(D1,D2,NEPR,NL,NLRC,NALFA,NLS,NLF)                     DRIVES
 1010 CONTINUE                                                          DRIVES
      IF ( ND .EQ. 0) GO TO  1040                                       DRIVES
      DO  1020  I=2,ND                                                  DRIVES
 1020 S(I)=S(I-1)+SQRT((DDX(I)-DDX(I-1))**2+(DDY(I)-DDY(I-1))**2)       DRIVES
      SP=S(1)                                                           DRIVES
      DX(1)=DDX(1)                                                      DRIVES
      DY(1)=DDY(1)                                                      DRIVES
       DZ(1)=DDZ(1)                                                     DRIVES
      DEPR(1)=DDEPR(1)                                                  DRIVES
      DDE(1)=DDDE(1)                                                    DRIVES
      SPP(1)=0.0                                                        DRIVES
      DO  1030  I=2,NFPP                                                DRIVES
      SP=SP+DS                                                          DRIVES
      SPP(I)=SP                                                         DRIVES
      DX(I)=TBLU1(SP,S,DDX,1,ND)                                        DRIVES
      DY(I)=TBLU1(SP,S,DDY,1,ND)                                        DRIVES
      DZ(I)=TBLU1(SP,S,DDZ,1,ND)                                        DRIVES
      DEPR(I)=TBLU1(SP,S,DDEPR,1,ND)                                    DRIVES
      DDE(I)=TBLU1(SP,S,DDDE,1,ND)                                      DRIVES
 1030 CONTINUE                                                          DRIVES
 1040 CONTINUE                                                          DRIVES
      CALL VDIM(D1,D2,NEPR,NL,NLRC,NALFA,NLS,NLF)                       DRIVES
      IF(IPLOT.EQ.0) GO TO  1050                                        DRIVES
      WRITE(2, 9000 )TITLE                                              DRIVES
 9000 FORMAT(18A4)                                                      DRIVES
      NFF=NFPP-1                                                        DRIVES
      WRITE (2,9001)NFF,NLN,NSL,(SD(K2),K2=1,NSL)                       DRIVES
 9001 FORMAT (3I5,3F10.0)                                               DRIVES
      WRITE (2,9002) (ANL(K3),K3=NLS,NLF)                               DRIVES
 9002 FORMAT(1PE15.6,4E15.6,I5)                                         DRIVES
 1050 CONTINUE                                                          DRIVES
      DO  1080  I=1,NFPP                                                DRIVES
      IF(I/2*2.EQ.I) GO TO  1060                                        DRIVES
      WRITE(6, 9003 )TITLE                                              DRIVES
 1060 CONTINUE                                                          DRIVES
 9003 FORMAT(1H1,30X,18A4)                                              DRIVES
C                                                                       DRIVES
      DSCIQ=DSCI                                                        DRIVES
      IMODEQ=IMODE                                                      DRIVES
      DXQ=DX(I)                                                         DRIVES
      DYQ=DY(I)                                                         DRIVES
      DZQ=DZ(I)                                                         DRIVES
      DEPRQ=DEPR(I)                                                     DRIVES
      DDEQ=DDE(I)                                                       DRIVES
      CALL VALUE2(D1,D2,NEPR,NL,NLRC,NALFA,NLS,NLF)                     DRIVES
      DO 1031 J=NLS,NLF                                                 DRIVES
      X1(J)=X1Q(J)                                                      DRIVES
      X2(J)=X2Q(J)                                                      DRIVES
      Y1(J)=Y1Q(J)                                                      DRIVES
      Y2(J)=Y2Q(J)                                                      DRIVES
      SUM(J)=SUMQ(J)                                                    DRIVES
      IEC(J)=IECQ(J)                                                    DRIVES
 1031 CONTINUE                                                          DRIVES
      DO 1032 J=1,NSL                                                   DRIVES
```

```
1032 SLNL(J)=SLNLC(J)                                                  DRIVES
     IF (I .EQ. 1 ) GO TO 1070                                         DRIVES
     IF(IPLOT.EQ.0) GO TO  1070                                        DRIVES
     WRITE (2,9022) DX(I),DY(I),SPP(I),(SLNL(IZ),IZ=1,NSL)             DRIVES
9022 FORMAT(1PE15.6,5E15.6)                                            DRIVES
     WRITE(2, 9002 )(X1(K),X2(K),Y1(K),Y2(K),SUM(K),IEC(K),K=NLS,NLF)  DRIVES
1070 CONTINUE                                                          DRIVES
     WRITE(6, 9004 )                                                   DRIVES
9004 FORMAT(1H )                                                       DRIVES
     WRITE(6, 9004 )                                                   DRIVES
     WRITE(6, 9005 ) DX(I),DY(I),DZ(I),PN(II)                          DRIVES
9005 FORMAT(10X,30HAIRCRAFT COORDINATES (X,Y,Z) =,1PE10.3,3H , ,E10.3, DRIVES
    * 3H , ,E10.3,5H     (,A3,2H) )                                    DRIVES
     WRITE (6,9004)                                                    DRIVES
     WRITE(6,8998)SPP(I),PN(II)                                        DRIVES
8998 FORMAT(9X,31H DISTANCE ALONG FLIGHT TRACK = ,1PE10.3,2X,A3)       DRIVES
     WRITE(6, 9004 )                                                   DRIVES
     WRITE (6, 9006 ) DDE(I),CSCI                                      DRIVES
9006 FORMAT(10X,23HENGINE ATTITUDE ANGLE =,1PE10.2,33H (DEGREES) , DIRE DRIVES
    *CTIVITY ANGLE = ,E10.2,11H (DEGREES)       )                      DRIVES
     WRITE(6, 9004 )                                                   DRIVES
     WRITE (6, 9007 ) DEPR(I)                                          DRIVES
9007 FORMAT(10X,31HENGINE PERFORMANCE PARAMETER = ,1PE10.3)            DRIVES
     WRITE(6, 9004 )                                                   DRIVES
     DO 1075 JKL=1,NSL                                                 DRIVES
     WRITE (6,9008) EM(III),SLNL(JKL),SD(JKL),PN(II)                   DRIVES
9008 FORMAT( 10X,15HNOISE LEVEL IN ,A3,5HDB = ,F6.1,16H  AT A SIDELINE , DRIVES
    *11HDISTANCE OF,1PE10.3,1X,A3)                                     DRIVES
1075 CONTINUE                                                          DRIVES
     WRITE(6, 9004 )                                                   DRIVES
     WRITE(6, 9004 )                                                   DRIVES
     WRITE (6, 9009 )                                                  DRIVES
9009 FORMAT(34X,14HCONTOUR POINTS    )                                 DRIVES
     WRITE(6, 9004 )                                                   DRIVES
     WRITE (6, 9010 )                                                  DRIVES
9010 FORMAT(2X,                                                        DRIVES
    *         110H  NOISE LEVEL       LEFT CONTOUR POINT         RIGHT CONT DRIVES
    1OUR POINT            ACCUMULATED AREA          ERROR CODE         ) DRIVES
     WRITE (6, 9011 ) EM(III),PN(II),PN(II),PN(II),PN(II),PN(II)       DRIVES
9011 FORMAT(5X,1H(,A3,3HDB),10X,1H(,A3,1H),7X,1H(,A3,1H),11X,1H(,A3,  DRIVES
    * 1H),7X,1H(,A3,1H),10X,8H(SQUARE ,A3,3H ) )                       DRIVES
     WRITE(6, 9004 )                                                   DRIVES
     WRITE (6, 9012 )(ANL(J),X1(J),Y1(J),X2(J),Y2(J),SUM(J),IEC(J),J=NL DRIVES
    1S,NLF)                                                            DRIVES
9012 FORMAT(4X,0PF8.1,7X,1PE10.3,2X,E10.3,6X,E10.3,2X,E10.3,8X,E10.3,  DRIVES
    * 14X,I5 )                                                         DRIVES
1080 CONTINUE                                                          DRIVES
     IF(ISTOP .EQ. 1 ) GO TO  1090                                     DRIVES
     GO TO  1000                                                       DRIVES
1090 CONTINUE                                                          DRIVES
     IF (IPLOT .LE. 0) GO TO  1120                                     DRIVES
1100 CONTINUE                                                          DRIVES
1110 CONTINUE                                                          DRIVES
     CALL PLOTIT(XP,YP,PS,FP,102,2,5)                                  DRIVES
1120 CONTINUE                                                          DRIVES
     RETURN                                                            DRIVES
     END                                                               DRIVES
```

```
      SUBROUTINE EDGEDI(NPSIX,PSIX,BCFIF,       USPLIF,CZ,THP,          EDGEDI
     1                  GAM,ROPP,THOPP,ETAP,PSIO,PSIOP,BW,TLE,          EDGEDI
     2                  PS2)                                            EDGEDI
C                                                                       EDGEDI
C  TITLE                                                                EDGEDI
C     EDGE DIFFRACTION                                                  EDGEDI
C                                                                       EDGEDI
C  PURPOSE                                                              EDGEDI
C     THIS SUBROUTINE CALCULATES THE EDGE DIFFRACTION BY THE FOLLOWING  EDGEDI
C     CALCULATIONS                                                      EDGEDI
C         BANDWIDTH EFFECT TERMS                                        EDGEDI
C         WAVE NUMBER                                                   EDGEDI
C         PATH LENGTH DIFFERENCES                                       EDGEDI
C         PHASE DIFFERENCE FOR INCIDENT AND IMAGE FIELDS                EDGEDI
C         REFERENCE PRESSURE FOR DIFFRACTED FIELD                       EDGEDI
C         DIFFRACTED PRESSURE FIELDS                                    EDGEDI
C         LEADING EDGE ADDITIONAL DIFFRACTED PRESSURE FIELD             EDGEDI
C         SUMMATION OF DIFFRACTED FIELDS THAT INCLUDES BANDWIDTH EFFECTS EDGEDI
C                                                                       EDGEDI
C  INPUT - CALLING SEQUENCE                                             EDGEDI
C     NPSIX    NUMBER OF DIRECTIVITY ANGLES PSIX                        EDGEDI
C     PSIX     DIRECTIVITY ANGLES AT WHICH USPLIF IS GIVEN              EDGEDI
C     BCFIF    CENTER FREQUENCY                                         EDGEDI
C     USPLIF   THE USPL FOR THE FREQUENCY BCF                           EDGEDI
C     CZ       AMBIENT SPEED OF SOUND                                   EDGEDI
C     GAM      TRANSFORMED WAVE NUMBER                                  EDGEDI
C     ROPP     MAGNITUDE OF TRANSFORMED SOURCE POSITION                 EDGEDI
C     THOPP    PHASE OF TRANSFORMED SOURCE POSITION                     EDGEDI
C     ETAP     TRANSFORMED OBSERVER ANGLE (ETA )                        EDGEDI
C     PSIO     DIRECTIVITY ANGLE FOR DIFFRACTED INCIDENT FIELD          EDGEDI
C     PSIOP    DIRECTIVITY ANGLE FOR DIFFRACTED IMAGE FIELD             EDGEDI
C     BW       FILTER BAND WIDTH                                        EDGEDI
C     TLE      LEADING EDGE TERM                                        EDGEDI
C                                                                       EDGEDI
C OUTPUT                                                                EDGEDI
C     PS2      SHIELDED MEAN SQUARE PRESSURE                            EDGEDI
C                                                                       EDGEDI
      DIMENSION PSIX(1),USPLIF(1),                                      EDGEDI
     1          A(3),B(3),C(3),D(3)                                     EDGEDI
      COMPLEX CFI,ALP1,BET1,BET2                                        EDGEDI
      DIMENSION RALP1(2),RBET1(2),RBET2(2)                              EDGEDI
      EQUIVALENCE (RALP1(1),ALP1), (RBET1(1),BET1), (RBET2(1),BET2)     EDGEDI
      COMPLEX CPOLAR                                                    EDGEDI
      DATA DEGRAD, RADDEG, PI, EPS /1.74532925194E-2, 57.295779513082,  EDGEDI
     * 3.14159265358 98, 1.E-10/                                        EDGEDI
C                                                                       EDGEDI
C     COMPUTE BANDWIDTH EFFECT ERM                                      EDGEDI
C                                                                       EDGEDI
      Q   = 10.**(.5*BW)                                                EDGEDI
      FA  = .5*( Q + 1./Q )                                             EDGEDI
      FB  = .5*( Q - 1./Q )                                             EDGEDI
C                                                                       EDGEDI
C     COMPUTE WAVENUMBER                                                EDGEDI
C                                                                       EDGEDI
      WKP = 2.*PI*GAM*BCFIF / CZ                                        EDGEDI
C                                                                       EDGEDI
C     COMPUTE PATHLENGTH DIFFERENCES                                    EDGEDI
```

```
C
      A2=ABS(2.*WKP*RCPP*COS(ETAP*DEGRAD))
      BL  = SIN( .5*(THP - THOPP)*DEGRAD )
      CL  = SIN( .5*(THP + THOPP)*DEGRAD )
      AL  = SQRT( A2 )
      AB  =AL*BL
      AC  =AL*CL
C
C     COMPUTE PHASE DIFFERNECE FOR INCIDENT AND IMAGE FIELDS
C
      DL  = SIN( THP*DEGRAD ) * SIN( THOPP*DEGRAD )
      GAM1= A2*DL
C
C     COMPUTE REFERENCE PRESSURE FOR DIFFRACTED FIELD
C     A TABLE LOOK-UP IS PERFORMED ON PSIX VERSUS USPLIF USING TBLU1
C
      USPLO   = TBLU1(PSIC,PSIX,USPLIF,2,NPSIX)
      USPLOP  = TBLU1(PSICP,PSIX,USPLIF,2,NPSIX)
      PO      = 10.**(.05*USPLO)
      POP     = 10.**(.05*USPLOP)
C
C     COMPUTE DIFFRACTED PRESSURE FIELDS WHERE SUBROUTINE CFI IS USED
C     WHICH COMPUTES THE FRESNEL INTEGRAL TIMES THE SQUARE ROOT OF
C     THE IMAGINARY UNIT TIMES PI
C
      ALP1= PO * CFI( AB )
      BET1= POP* CFI( AC )
C
C     CONTINUE WHEN A2 IS NOT NEAR ZERO
C
  100 ALP1=CPOLAR(ALP1)
      BET1=CPOLAR(BET1)
      N = 1
      A(1)=RALP1(1)*RALP1(1) + RBET1(1)*RBET1(1)
      B(1)= 2.* RALP1(1)*RBET1(1)
      C(1) = GAM1
      D(1) = RBET1(2) - RALP1(2)
C
C     COMPUTE LEADING EDGE ADDITIONAL DIFFRACTED PRESSURE FIELD
C
      IF(AL.EQ.0.)GO TO 200
      IF( TLE.EQ.0. ) GO TO 200
      N = 3
      BET2=0.3989423*TLE*( (PO*BL+POP*CL)/AL )*CMPLX(1.,1.)
      BET2=CPOLAR(BET2)
      A(1) = RALP1(1)*RALP1(1)
      A(2) = RBET1(1)*RBET1(1)
      A(3) = RBET2(1)*RBET2(1)
      B(2) = 2.*RALP1(1)*RBET2(1)
      B(3) = 2.*RBET1(1)*RBET2(1)
      C(2)=-A2*0.5
      C(3) = C(2) - C(1)
      D(2) = RBET2(2) - RALP1(2)
      D(3) = RBET2(2) - RBET1(2)
C
C     SUM DIFFRACTED FIELDS
C     DETERMINE SHIELDED MEAN SQUARE PRESSURE
```

```
C
  200 PS2 = 0.
      DO 300 J=1,N
      TERM=B(J)*COS(C(J)*FA-D(J))
      CJFB = C(J)*FB
      IF( CJFB.EQ.0.) GO TO 290
      TERM = TERM * SIN( CJFB ) / CJFB
  290 PS2=PS2+TERM+A(J)
  300 CONTINUE
C
 1000 RETURN
      END
```

```
      SUBROUTINE EEGEOM(IEDGE,ITYPE,
     1                  U,V,W,E1,E2,E3,RC,THO,ROV,Q,DLT,ALP,ALPO,AF)
C
C  TITLE
C     ENGINE EDGE GEOMETRY
C
C  PURPOSE
C     THIS SUBROUTINE CALCULATES ENGINE/EDGE GEOMETRY WHICH CONSISTS OF
C     CALCULATING THE FOLLOWING
C         UNIT VECTORS FOR WING EDGES AND ENGINE RELATIVE TO HALF PLANE
C         ENGINE CENTERLINE ORIENTATION RELATIVE TO EDGES
C         FLOW INCIDENT ANGLE
C         INLET OR NOZZLE COORDINATES RELATIVE TO EDGE
C
C  INPUT - CALL SEQUENCE
C     IEDGE  - = 1 FOR TRAILING EDGE
C                2 FOR  LEADING EDGE
C                3 FOR TIP EDGE
C     ITYPE  - = 4 FOR INLET FAN NOISE
C              NOT 4 FOR DISCHARGE TURBOMACHINERY NOISE
C
C   NPUT - COMMON
C         EWGEO  - ALL VARIABLES ARE USED
C     REFRAC - IWED ONLY IS USED
C
C  OUTPUT
C     U,V,W     UNIT VECTORS FOR WING EDGE
C     E1,E2,E3 COORDINATE SYSTEM UNIT VECTORS FIXED TO ENGINE SUCH THAT
C               E1 IS PARALLEL TO HALF-PLANE
C     RC,THO    POLAR COORDINATES OF INLET OR NOZZLE RELATIVE TO EDGE
C     ROV       VECTOR OF INLET OR NOZZLE
C     Q         VECTOR DEPENDING ON EDGE TYPE
C     DLT,ALP   ENGINE CENTERLINE ORIENTATION ANGLES RELATIVE TO EDGE
C     ALPO      FLOW  INCIDENT ANGLE
C
C  NOTE
C     ALL ANGLES INPUT AND OUTPUT ARE IN DEGREES
C
      DIMENSION U(3),V(3),W(3),E1(3),E2(3),E3(3),ROV(3),
     1          Q(3),AF(3)
C
      COMMON/EWGEO/ SWPTE,SWPLE,DIHED,CDSD,DDX1D,DDX2D,DDXOD,DDY1D,
     1              DDY2D,DDYOD,DDLD,DIANI
      COMMON/REFRAC/EMJ,TSTSO,IWED(3),CFASS,BETA(10),CPSI(10),NASRC
C
      DATA DEGRAD, RADDEG /1.745329251943E-2, 57.29577951308?/
C
C     UNIT VECTOR COMPUTATION
C
C         COMPUTE U AND V DEPENDING UPON EDGE TYPE
C
      IF(      IEDGE -2 ) 100,200,400
C
C               COMPUTE Q VECTOR FOR THE TRAILING EDGE
C
  100 Q(1) = 0.
      Q(2) = -DDX1D
```

```
      Q(3) = -DDY1D
      ALP  = -SWPTE
      GO TO 300
C
C                 COMPUTE Q VECTOR FOR THE LEADING EDGE
C
  200 Q(1) = 0.
      Q(2) = DDX2D
      Q(3) = -DDY2D
      ALP  = -SWPLE
C
C                 COMPUTE U AND V FOR TRAILING OR LEADING EDGE
C
  300 SN   = SIGN(1.,Q(2))
      U(1) = SN*COS( ALP*DEGRAD )
      U(2) = SN*SIN( ALP*DEGRAD )
      U(3) = U(1) * TAN( DIHED*DEGRAD )
      CALL VECN( U )
      DOT   = DOTP(Q,U)
      V(1) = Q(1) - DOT *U(1)
      V(2) = Q(2) - DOT*U(2)
      V(3) = Q(3) - DOT *U(3)
      CALL VECN( V )
      GO TO 500
C
C                 COMPUTE U AND V FOR TIP EDGE
C
  400 BETAX= ATAN( (DDY1D-DDY2D) / ( DDX1D+DDX2D ) )
      U(1) = 0.
      U(2) = - COS( BETAX)
      U(3) = - SIN( BETAX)
      V(1) = COS( DIHED*DEGRAD )
      V(2) = 0.
      V(3) = SIN( DIHED*DEGRAD )
C
C            COMPUTE W, E1, E2 AND E3
C
  500 CALL CROSP(W,U,V)
      E2(1) = 0.
      E2(2) = 1.
      E2(3) = 0.
      CALL CROSP(E1,E2,W)
      CALL VECN(E1)
      CALL CROSP(E3,E1,E2)
C
C     COMPUTE ENGINE CENTERLINE ORIENTATION ANGLES RELATIVE TO EDGE
C
      DLT = ATAN2( W(2), -V(2) ) *RADDEG
      ALP = ASIN( U(2) ) *RADDEG
C
C     COMPUTE FLOW INCIDENT ANGLE
C
      DOT   = DOTP(E2,W)
      Q(1) = DOT    * W(1) - E2(1)
      Q(2) = DOT     * W(2) - E2(2)
      Q(3) = DOT    * W(3) - E2(3)
      CALL VECN( Q )
```

```
      ALPO = ACOS( DOTP(Q,V) ) * RADDEG
C
C     STORE UNIT VECTOR IN DIRECTION OF AMBIENT FLOW
C
      AF(1)=Q(1)
      AF(2)=Q(2)
      AF(3)=Q(3)
C
C     COMPUTE NOZZLE OR INLET POLAR COORDINATES RELATIVE TO EDGE
C
      XOP = DDXOD
      IF( ITYPE.EQ.4 ) XOP = XOP - DDLD
C
C         COMPUTE VECTOR DEPENDING UPON EDGE TYPE
C
      IF( IEDGE - 2 )700,800,900
C
C               TRAILING EDGE
C
  700 Q(1) = 0.
      Q(2) = -( DDX1D - XOP )
      Q(3) = -( DDY1D + DDYOD )
      GO TO 1000
C
C               LEADING EDGE
C
  800 Q(1) = 0.
      Q(2) = DDX2D + XOP
      Q(3) = -( DDY2D + DDYOD )
      GO TO 1000
C
C               TIP EDGE
C
  900 Q(1) = DDSD
      Q(2) = XOP
      Q(3) = - DDYOD + DDSD* TAN( DIHED*DEGRAD )
C
C         COMPUTE THE COORDINATES
C
 1000 DOT  =  DOTP(Q, U) * DIANI
      DO  1010  I = 1,3
      Q(I)  =  Q(I) * DIANI
      ROV(I)  =  Q(I) - DOT * U(I)
 1010 CONTINUE
      RO  =  SQRT(ROV(1)*ROV(1) + ROV(2)*ROV(2) + ROV(3)*ROV(3))
      THO = ACOS( DOTP(ROV,V) / RO ) *RADDEG
C
      RETURN
      END
```

```
      SUBROUTINE EGACAL(D, BETA, NFB, F, ATN)
C     VERSION B    DATE 19 DEC 72.
C
C     REFERENCE- D.G. DUNN, /NOTICE OF REVISIONS FOR EGA ROUTINES/,
C                TECHNICAL MEMO ANSFTM-2, 14 DEC 1972.
C
C     PROGRAM TO CALCULATE THE EXTRA GROUND ATTENUATION DUE TO THE TUR-
C     BULENT BOUNDARY LAYER OF THE AIR NEAR THE GROUND PLANE. REFER TO
C     FIGURE 3 OF SAE-AIR876A AND FIGURE 4 OF SAE-AIR923.
C     THE RMS CALCULATION ERROR IS LESS THAN 0.1 DB WITH RESPECT TO
C     FIGURE 3 OF SAE-AIR876A. THE DECAY TERM FOR ELEVATION ANGLE BETA
C     REPRESENTS THE BEST FIT FOR FIGURE 4 OF SAE-AIR923.
C
C     INPUTS. D = DISTANCE BETWEEN SOURCE AND OBSERVER IN FT.
C          BETA = ELEVATION ANGLE IN DEG BETWEEN THE HORIZONTAL
C                 GROUND PLANE AND THE OBSERVERS LINE OF SIGHT TO
C                 THE NOISE SOURCE (OBSERVER ON THE GROUND)
C          NFB =  NUMBER OF FREQUENCY BANDS
C          F   =  AN ARRAY OF (NFB) BAND CENTER FREQUENCIES IN HZ.
C
C     OUTPUT. ATN =  THE ARRAY OF EXTRA GROUND ATTENUATION VALUES FOR
C                 EACH FREQUENCY BAND.
C
C     ALLOCATE STORAGE FOR OTHER ARRAYS
      DIMENSION F(1),ATN(1), EGA(7),C1(6),C2(6),C3(6),C4(6),C0(6),C(8,6)
     1,DANG(5),DF(5,6)
      REAL LBCF(7)
      DOUBLE PRECISION SUM, POW, DTERM
      DATA LBCF /0.,1.724546,2.025592,2.326602,2.627632,2.928667,
     1 3.229682/
      DATA EGA /7*0./
      DATA DANG /0., 2., 10., 20., 45./
      DATA DF /1.,1.,.186,.163,0., 1.,1.,.297,.183,0., 1.,1.,.352,.188,
     1 0., 1.,1.,.406,.198,0., 1.,1.,.468,.214,0., 1.,1.,.534,.235,0./
      DATA C0 /2.5500705,3.7005697,4.854333,6.1758828,7.3126577,
     1 8.7609923/
      DATA C/7.4685316,9.8170563,-116.11669,-513.50033, 3593.272,25113.8
     227,-87306.197,-795555.28,9.0470852,20.067737,-121.04562,-1147.6826
     3,3896.0422,58647.28,-102929.41,-1900833.5, 11.494171, 22.452756,
     4-131.24292,-1178.1871, 4059.3326, 60285.99,-109376.69,-2006965.9,
     514.933911, 23.003503,-202.45769,-1217.1785, 6696.1366, 60729.708,
     6-178956.39,-1992028.1, 16.609834, 18.789958,-187.864,-797.87204,
     75607.9789, 35470.374,-139668.42,-1079105.8, 19.031016, 13.761267,
     8-243.34348,-832.97531, 7773.8292, 45614.595,-203312.87,-1620027.1/
      DATA C1 /2.4072E-3,3.4204E-3,4.608E-3,5.872E-3,7.24E-3,8.192E-3/
      DATA C2 /5.0,7.2,10.0,12.0,15.0,16.0/
      DATA C3 /-7.966,-10.276,-7.443,-8.124,-4.632,-5.356/
      DATA C4 /3.041,3.075,3.1303,3.1265,3.0196,2.9982/
      X  =  ABS(D)
      IF  (X - 1.)  2, 2, 1
    1 J  =  BETA / 90.
      ANG  =  ABS(BETA - 90. * FLOAT(J))
      IF  (MOD(J,2) .NE. 0)  ANG = 90. - ANG
      IF  (ANG - 45.)  4, 2, 2
    2 DO  3  I = 1,NFB
      ATN(I)  =  0.
    3 CONTINUE
```

```
      GO TO 20                                                          EGACAL
    4 IF  (X - 250.)  5, 5, 7                                           EGACAL
    5 DO  6  J = 1,6                                                    EGACAL
      EGA(J+1)  =  C1(J) * X                                            EGACAL
    6 CONTINUE                                                          EGACAL
      GO TO 13                                                          EGACAL
    7 X = ALOG10(X)                                                     EGACAL
      IF  (X - 3.6)  10, 8, 8                                           EGACAL
    8 DO  9  J = 1,6                                                    EGACAL
      EGA(J+1)  =  C2(J) * (1. - EXP(C3(J) * (X - C4(J))))              EGACAL
    9 CONTINUE                                                          EGACAL
      GO TO 13                                                          EGACAL
C                                                                       EGACAL
C   COMPUTE EGA BY THE TAYLOR SERIES LEAST-SQUARE-FIT.                  EGACAL
   10 N  =  8                                                           EGACAL
      XX  =  X - 3.0789521                                              EGACAL
      DO  12  J = 1,6                                                   EGACAL
      POW  =  1.                                                        EGACAL
      SUM  =  C0(J)                                                     EGACAL
      DO  11  I = 1,N                                                   EGACAL
      POW  =  POW * XX / FLOAT(I)                                       EGACAL
      DTERM  =  POW * C(I,J)                                            EGACAL
   11 SUM  =  SUM + DTERM                                               EGACAL
      EGA(J+1)  =  SUM                                                  EGACAL
   12 CONTINUE                                                          EGACAL
   13 DO  14  J = 1,6                                                   EGACAL
      EGA(J+1)  =  EGA(J+1) * TBLU1(ANG, DANG, DF(1,J), 1, 5)           EGACAL
   14 CONTINUE                                                          EGACAL
      DO  19  I = 1,NFB                                                 EGACAL
      X  =  ABS(F(I))                                                   EGACAL
      IF  (X - 1.)  15, 15, 16                                          EGACAL
   15 ATN(I) = 0.                                                       EGACAL
      GO TO 19                                                          EGACAL
   16 X  =  ALOG10(X)                                                   EGACAL
      IF  (X - LBCF(7))  18, 17, 17                                     EGACAL
   17 ATN(I)  =  EGA(7)                                                 EGACAL
      GO TO 19                                                          EGACAL
   18 ATN(I)  =  TBLU1(X, LBCF, EGA, 1, 7)                              EGACAL
   19 CONTINUE                                                          EGACAL
   20 RETURN                                                            EGACAL
      END                                                               EGACAL
```

```
      SUBROUTINE EJECT                                                  EJECT
C AUTHOR              D. F. MELORUM                                     EJECT
C                                                                       EJECT
C PURPOSE             TO PREDICT JET NOISE FOR MULTIPLE ELEMENT/TUBE    EJECT
C                     NOZZLES FOR THE PHASE B                           EJECT
C                     NASA-AMES FOOTPRINT CONTRACT NAS2-6969.           EJECT
C                                                                       EJECT
C METHOD              AS DESCRIBED IN REFERENCE 1).                     EJECT
C                                                                       EJECT
C INPUTS              VIA LABLED COMMON                                 EJECT
C                                                                       EJECT
C                                                                       EJECT
C                     VIA LABLED COMMON SWITCH                          EJECT
C                                                                       EJECT
C                     NUMENG    NUMBER OF NOISE SOURCES OF THE SAME     EJECT
C                               NOISE TYPE.                             EJECT
C                                                                       EJECT
C                     VIA LABLED COMMON GCOMON                          EJECT
C                                                                       EJECT
C                     NOF       1/3 OCTAVE OF FULL OCTAVE SWITCH        EJECT
C                               OR NUMBER OF FREQUENCY BANDS (8 OR 24)  EJECT
C                     RETA(24)  DIRECTIVITY ANGLES                      EJECT
C                                                                       EJECT
C                     VIA LABLED COMMON GPRAM                           EJECT
C                                                                       EJECT
C                     AMACH     MACH NUMBER OF THE AIRCRAFT             EJECT
C                     NOBS      NUMBER OF OBSERVER POSITIONS            EJECT
C                                                                       EJECT
C                     VIA LABLED COMMON SUMSPL                          EJECT
C                                                                       EJECT
C                     SSPL      CURRENT TOTAL PREDICTED NOISE FOR NOF   EJECT
C                               (8 OR 24) FREQUENCIES, AT NOBS OBSERVER EJECT
C                               POSITIONS FOR 17 DIRECTIVITY ANGLES.    EJECT
C                                                                       EJECT
C                     VIA LABLED COMMON ANGLE (SET UP BY SUBROUTINE ANGLES EJECT
C                                                                       EJECT
C                     PSI       17 DIRECTIVITY ANGLES FOR EACH OF       EJECT
C                               NOBS OBSERVER POSITIONS.                EJECT
C                     PSIC      17 DIRECTIVITY ANGLE PROJECTIONS FOR    EJECT
C                               EACH OF NOBS OBSERVER POSITIONS         EJECT
C                     BETA      ELEVATION ANGLE PROJECTION FOR EACH     EJECT
C                               OF NOBS OBSERVER POSITIONS.             EJECT
C                                                                       EJECT
C                     EACH COMPONENT IS WRITTEN ON TAPE OR FILE 10      EJECT
C                     FOR EACH OF NOF BANDS FOR EACH OF NOBS OBSERVER   EJECT
C                     POSITIONS.                                        EJECT
C                                                                       EJECT
C OUTPUTS             VIA LABLED COMMON SUMSPL                          EJECT
C                                                                       EJECT
C                     SSPL      CURRENT TOTAL PREDICTED NOISE FOR       EJECT
C                               8 OR 24 FREQUENCIES, AT NOBS OBSERVER   EJECT
C                               POSITIONS FOR 17 DIRECTIVITY ANGLES.    EJECT
C                                                                       EJECT
C                     VIA LABLED COMMON ANGLE (SET UP BY SUBROUTINE ANGLES EJECT
C                                                                       EJECT
C                     PSI       17 DIRECTIVITY ANGLES FOR EACH OF       EJECT
C                               NOBS OBSERVER POSITIONS.                EJECT
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C                      PSIO        17 DIRECTIVITY ANGLE PROJECTIONS FOR       EJECT
C                                  EACH OF NOBS OBSERVER POSITIONS            EJECT
C                      BETA        ELEVATION ANGLE PROJECTION FOR EACH        EJECT
C                                  OF NOBS OBSERVER POSITIONS.                EJECT
C                                                                             EJECT
C                                                                             EJECT
C FUNCTION SUBPRGM    COS         ESHLDG     PWRSUM                           EJECT
C                                                                             EJECT
C SUBROUTINES         ANGLES      MENC22          ZERO                        EJECT
C                                                                             EJECT
C                                                                             EJECT
C                                                                             EJECT
      COMMON /EJECTD/ IEJECT,NUMTBS,AREA,AR,TS,AMACHJ,AMACHS,CV,              EJECT
     *  PS,PAREA,PTS,PMACHJ,PCV,EJANG,                                        EJECT
     *ICOR9,LIN9,NTH9,IMA9,LGMS,NWLS,ICF9,ILAY9,                              EJECT
     *TF9(10),PCTAS(10),PLAS(10),                                             EJECT
     *ELOH9,EDH9,RIW9(10),TL9(10),CF9,FM9                                     EJECT
C                                                                             EJECT
C                                                                             EJECT
      COMMON/SWITCH/NTYPE,ITYPE,NENG,IOCF,IPRT(7),ION(13),ALLPT               EJECT
C                                                                             EJECT
      COMMON/TMSPL/SPZ(24,17),IB(2,3,13)                                      EJECT
C     CONSTANTS USED IN INTERNAL CALCULATIONS                                 EJECT
C                                                                             EJECT
      COMMON /GCONST/ IN,IO,IT1,IT2,F0,F1,F2,F3,F4,F5,F6,F7,F8,F9,F10,        EJECT
     *                I0,I1,I2,I3,I4,I5,I6,I7,I8,I9,I10,P1,P33,P5,P001,       EJECT
     *                EPS,UNDEF,BL,ICD,DPR,RPD,STA(17),M1,FM1,I17,A,PI        EJECT
C                                                                             EJECT
C     VARIABLE SET CALCULATED IN THE PROGRAM PROCESSING                       EJECT
C                                                                             EJECT
      COMMON /GCOMON/ NCF,NK,BCF(24),TSPL(24,10,17),SPLT(24,17),              EJECT
     *BUF(25),RETA(17),SPL2(17),TGAGR(24),DLPSF(17)                           EJECT
      COMMON/SUMSPL/SSPL(24,10,17)                                            EJECT
      COMMON/PNLD/PSPL(17,20),EPNL(5,10),TEPNL(5,10)                          EJECT
C                                                                             EJECT
C     FREQUENCY BANDS USED BY PROGRAM                                         EJECT
C                                                                             EJECT
      COMMON /GFREQ/ CFREQ(24),LFREQ(25),PFREQ(24)                            EJECT
C                                                                             EJECT
C     GENERAL INPUT PARAMETERS                                                EJECT
      COMMON/ANGLE/PSI(17,10),PSIO(17,10),BETA(17,10)                         EJECT
C                                                                             EJECT
      COMMON /GPRAM/ALTP,ALTR,SLOPE,AMACH,NOBS,SLDIST(10),ITENG,IUNIT         EJECT
     *     ,ISPTRM,IATMOS,IAIR,UAIRAB(24),NTEMP,TEMP(50),TALT(50)             EJECT
     *     ,NPRES,PRES(50),PALT(50),NHUMID,HALT(50),RHUMID(50),CTEMP          EJECT
     *     ,CPRES,CRHUMD,IEGA,IGCR,CTEMP,DPRES,DHUMID,XKN,NC,FLD(50),         EJECT
     * ZNR(50),ZNI(50),LINECT,MAXLIN,IPAGE,BCG,TCG,FLR,AALT,EPF               EJECT
C                                                                             EJECT
C     AIRCRAFT-OBSERVER GEOMETRY OUTPUTS                                      EJECT
C                                                                             EJECT
      COMMON /GEOMO/ APY(10,17),APZ(10,17),PD(10,17),DFND(10,17),             EJECT
     * B1(10,17),B2(10,17),TOS(17,10),TPD(17,10),IRR(10,17)                   EJECT
     *,APP,TP,RHP,APC,TC,RHC,CA,CZ,TSP(17,10),CCV                             EJECT
C                                                                             EJECT
C     CONVERSION CONSTANTS                                                    EJECT
C                                                                             EJECT
      COMMON/GCONVC/C(2,10),SLDISX(10)                                        EJECT
```

```
      COMMON/HEAD/HIN(20),HOUT(20),CHIN(20)                             EJECT
C                                                                       EJECT
C                                                                       EJECT
      DIMENSION PSZ(24,17)                                              EJECT
C                                                                       EJECT
      ICN(9)=ICN(9)+1                                                   EJECT
C                                                                       EJECT
C                                                                       EJECT
      DELTA=EJANG*RPD                                                   EJECT
      ALPHA=DELTA-ATAN(SLOPE)                                           EJECT
      AN=NUMTBS                                                         EJECT
      CALL ANGLES(NOBS,DELTA)                                           EJECT
C                                                                       EJECT
C                                                                       EJECT
C     LOOP FOR THE NUMBER OF OBSERVER POSITIONS                         EJECT
C                                                                       EJECT
   40 DO 1000 M=1,NOBS                                                  EJECT
C                                                                       EJECT
C                                                                       EJECT
C     CALCULATE THE PRE MERGE JET NOISE PREDICTION                      EJECT
C                                                                       EJECT
      CALL MERG2Z(IEJECT,1,AREA,TS,AMACHJ,CV,AN,AMACHS,AR,PS,CZ,        EJECT
     *          APO,PSI(1,M ),CFREQ(1),SPLT(1,1),FBPF)                  EJECT
      CALL LINCOR(SPZ(1,1),IMAS,LGMS,ELCH9,SDHS,NWL9,K1N9,TL9,          EJECT
     *ILAY9,FMS,IDP9,PSI(1,M),NCF,BCF,PLA9,CF9,PCTA9,NTF9,TF9,          EJECT
     *DOPSF,SPL2,ICOR9,IB(1,1,ITYPE),LINS,FBPF)                         EJECT
C                                                                       EJECT
C                                                                       EJECT
   45 CONTINUE                                                          EJECT
C                                                                       EJECT
C     CONVERT TO A UNIT OR INDEXED SPECTRA                              EJECT
C                                                                       EJECT
      ENG=NENG                                                          EJECT
      IF(ENG.LE.0.0) ENG=1.0                                            EJECT
      DO 50 J=1,17                                                      EJECT
      ELVANG=BETA(J,M)                                                  EJECT
      DANGLE=PSIO(J,M)                                                  EJECT
      ENS=ESHLOG(DANGLE,ELVANG,ENG)                                     EJECT
      DO 50 K=1,24                                                      EJECT
   50 SPLT(K,J)=SPLT(K,J)-ENS                                           EJECT
      IF(NCF.EQ.24) GO TO 300                                           EJECT
C                                                                       EJECT
C     CONVERT 1/3 OCTAVE TO FULL OCTAVE                                 EJECT
C                                                                       EJECT
      DO 200 J=1,17                                                     EJECT
      DO 200 K=1,8                                                      EJECT
      SPLT(K,J)  =  SPLT(3*K-1,J) + 4.8                                 EJECT
  200 CONTINUE                                                          EJECT
C                                                                       EJECT
C                                                                       EJECT
C     ADD TO CURRENT TOTAL AND WRITE ON TAPE 10                         EJECT
C                                                                       EJECT
C                                                                       EJECT
  300 DO 400 J=1,NCF                                                    EJECT
      DO 350 K=1,17                                                     EJECT
  350 SPLT(J,K)=SPLT(J,K)-SPZ(J,K)                                      EJECT
  400 CONTINUE                                                          EJECT
```

```
   CALCULATE THE POSTMERGE JET NOISE PREDICTION

   CALL MENOZZ(IEJECT,2,AREA,PTS,PMACHJ,PCV,ALPHA,AMACH,AR,PAREA,
  *           CZ,APO,PSI(1,M),CFREC(1),PSZ(1,1),FBPF)



   CONVERT TO A UNIT CR INDEXED SPECTRA

   ENG=NENG
   IF(ENG.LE.0.0) ENG=1.C
   DO 550 J=1,17
   ELVANG=BETA(J,M)
   DANGLE=PSIO(J,M)
   ENS=ESHLDG(DANGLE,ELVANG,ENG)
   DC 550 K=1,24
50 PSZ(K,J)=PSZ(K,J)-ENS
   IF(NCF.EQ.24) GO TO 700

   CONVERT 1/3 OCTAVE TO FULL OCTAVE

   DO 600 J=1,17
   DO 600 K=1,8
   PSZ(K,J)  =  PSZ(3*K-1,J) + 4.8
00 CONTINUE


   ADD TO CURRENT TOTAL AND WRITE ON TAPE 10


CC DC 800 J=1,NCF
   DO 75C K=1,17
   SPLT(J,K)=PWRSUM(SPLT(J,K),PSZ(J,K))
50 SSPL(J,M,K)=PWRSUM(SSPL(J,M,K),SPLT(J,K))
C  CONTINUE
   IF(IPRT(7).NE.7)GO TO 41C
   CALL NOISO(IPRT(7),M,NK,10,CHIN,IUNIT,SLDISX(M),PFREQ,SPLT(1,1),
  *  NCF,ITYPE)
0  CONTINUE
   DO 36C JC=1,NCF
   DO 360 KC=1,17
0  SPLT(JC,KC)=SPLT(JC,KC)-TSPL(JC,M,KC)
   CALL PNLSUB(SPLT(1,1),PSPL(1,M),TFD(1,M),EPNL(1,M),SPLZ,
  *TEPNL(1,M),NK,BCG,TCG,FLR,M,NCBS,IRR(M,1))
   IF(IPRT(3).NE.3)GO TO 10C0
   CALL NOISO(IPRT(3),M,NK,12,CHIN,IUNIT,SLDISX(M),PFREQ,
  *    SPLT(1,1),NCF,ITYPE)



0C CONTINUE
   RETURN
   END
```

```
      SUBROUTINE EDGEOM(X,Y,ZEDN,DELT3,U,V,W,THO,DLT,ALP,
     1                  ETA,TH,PSIO,PN)
C
C  TITLE
C     EDGE/OBSERVER GEOMETRY
C
C  PURPOSE
C     THIS SUBROUTINE DEFINES THE EDGE/OBSERVER GEOMETRY CONSISTING OF
C     THE FOLLOWING BASIC STEPS
C         UNIT VECTOR FOR SOUND PROPAGATION
C         DIRECTION ANGLES RELATIVE TO EDGE
C         DIRECTIVITY ANGLE GRAZING WING EDGE
C
C  INPUT - CALL SEQUENCE
C     X,Y,ZEDN AIRCRAFT COORDINATES RELATIVE TO OBSERVER
C     DELT3    ENGINE INCLINATION ANGLE RELATIVE TO HORIZON
C     U,V,W    UNIT VECTORS FOR WING EDGE
C     THO      ANGLE OF POLAR COORDINATE OF INLET OR NOZZLE RELATIVE TO
C              EDGE
C     DLT,ALP  ENGINE CENTER LINE ORIENTATION ANGLES RELATIVE TO EDGE
C
C  OUTPUT
C     ETA,TH   DIRECTION ANGLES RELATIVE TO EDGE
C     PSIO     DIRECTIVITY GRAZING ANGLE
C     PN       UNIT VECTOR FOR SOUND PROPAGATION
C
C  NOTE
C     ALL INPUT AND OUTPUT ANGLES ARE IN DEGREES
C
      DIMENSION U(3),V(3),W(3),PN(3)
      DATA DEGRAD, RADDEG /1.745329251943E-2, 57.295779513082/
C
C     COMPUTE UNIT VECTOR FOR SOUND PROPAGATION
C
      SIND3 = SIN(DELT3*DEGRAD)
      COSD3 = COS(DELT3*DEGRAD)
      PN(1) = X
      PN(2) = -Y*COSD3 - ZEDN*SIND3
      PN(3) =  Y*SIND3 - ZEDN*COSD3
      CALL VECN(PN)
C
C     COMPUTE DIRECTION ANGLES
C
      ETA = ASIN( DOTP(PN,U) )*RADDEG
      TH  = ATAN2(-DOTP(PN,W),DOTP(PN,V) )*RADDEG
C
C     COMPUTE GRAZING ANGLE
C
      PSIO = 180. - ACOS( COS(ALP*DEGRAD)*COS(ETA*DEGRAD)*COS((THO-DLT)*
     1       DEGRAD) - SIN(ALP*DEGRAD)*SIN(ETA*DEGRAD) )*RADDEG
C
      RETURN
      END
```

```
      SUBROUTINE EPNLI(PNL,T,N,H,TO,CNF,ANS,IGLPNL)
C
      DIMENSION T(2), PNL(2), ANS(5)
C
C  PURPOSE
C     TO COMPUTE EFFECTIVE PERCEIVED NOISE LEVEL. COMPUTATION INVOLVES
C     INTEGRATION OF THE PNL-TIME HISTORY OVER THE LIMITS (PNLN,PNLX)
C     AND (TN, TX), I.E.
C
C     EPNL   =  PNLX + 10 * ALOG10((1 / TO) *
C               INTEGRAL( ANTILOG(0.1 * (PNL - PNLX)) * DT ))
C
C  WHERE
C     PNLX   =  MAXIMUM PNL
C     PNLN   =  AMAX1(PNLX - H, CNL)
C     TN     =  MINIMUM TIME WHEN PNL = PNLN
C     TX     =  MAXIMUM TIME WHEN PNL = PNLN
C
C  INPUTS
C    1) T       ... ARRAY OF (N) TIME VALUES, EACH CORRESPONDING TO THE
C                   TIME WHEN A (PNL) VALUE IS OBSERVED.
C    2) PNL     ... ARRAY OF (N) PNL VALUES FOR THE TIME HISTORY.
C    3) N       ... NUMBER OF POINTS FOR THE TIME HISTORY
C    4) TO      ... NORMALIZING TIME CONSTANT IN THE INTEGRAL FORMULA.
C                   NORMALLY THIS IS TEN SECONDS
C    5) H       ... PNL INCREMENT DOWN FROM THE MAXIMUM (PNLX) USED TO
C                   DETERMINE THE INTEGRATION LIMITS IF (PNLX .GT.
C                   (CNL + H)). NORMALLY (H) IS TEN PNDB.
C    6) CNF     ... CUTOFF OR NOISE FLOOR USED AS AN ADDITIONAL CONSTRAINT
C                   IN DETERMINING THE INTEGRATION LIMITS. FUNCTIONS ONLY
C                   IF (PNLX .LE. (CNF+H)).
C
C  OUTPUT
C    1) EPNL    ... THE EFFECTIVE PNL IN (EPNDB)
C    2) PNLN
C       PNLX    ... MIN/MAX PNL USED IN THE INTEGRATION FORMULA
C    3) TN
C       TX      ... MIN/MAX TIME USED IN THE INTEGRATION FORMULA
C    4) IGLPNL... FUNCTION VALUE USED AS AN ERROR CODE.
C                 =  0   FOR NO ERROR
C                 =  1   FOR BAD INPUTS, RESULTS SET TO OMEGA, I.E. 1.E75
C                 =  2   INTEGRATION LIMITS ARE UNDEFINED, RESULTS ARE
C                        SET TO OMEGA.
C
C  REMARKS
C    1) ASSUMES LINEAR VARIATION BETWEEN POINTS (T, PNL) FOR INTERPOLA-
C       TION, EXTRAPOLATION, AND COMPUTATION OF THE INTEGRAL.
C    2) INPUTS (TO, H, N) MUST BE GREATER THAN (0., 0., 2).
C
C.................................................................
      LOGICAL A, B
      DATA I1,I2, F0, F1  F10, C1, OMEGA /1,2,0.,1.,10.,.23025851,1.E75/
      TCX(X1,X2,Y1,Y2) = (X1*(Y2-PNLN) + X2*(PNLN-Y1)) / (Y2-Y1)
      DA(X1)  =  X1 * XPM1DX(C3) * DT
      EPNL  =  OMEGA
      TN=OMEGA
      TX=OMEGA
```

```
      PNLN=OMEGA
      PNLX=OMEGA
      IGLPNL  =  I1
C
C ERROR CHECKS
      IF  ((N .LE. I2) .OR. (TC .LE. FC) .OR. (H .LE. FO))  GO TO 160
      IGLPNL  =  I2
C
C  SORT POINTS WITH RESPECT TO INCREASING (T) AND FIND (PNLX)
      KE  =  N - I1
      DO  20  K = 1,KE
      JS  =  K + I1
      DO  20  J = JS,N
      IF  (T(J) - T(K))  10, 20, 20
   10 DT  =  T(J)
      T(J)  =  T(K)
      T(K)  =  DT
      DT  =  PNL(J)
      PNL(J)  =  PNL(K)
      PNL(K)  =  DT
   20 CONTINUE
      MT  =  I1
      PNLX  =  PNL(1)
      DO  50  K = I2,N
      IF  (PNLX - PNL(K))  30, 40, 50
   30 PNLX  =  PNL(K)
   40 MT  =  K
   50 CONTINUE
      IF  ((MT .LE. I1) .OR. (MT .GE. N) .OR. (PNLX .LE. CNF)) GO TO 160
      PNLN  =  AMAX1(PNLX - H, CNF)
      CO  =  EXP(C1 * (PNLN - PNLX))
      I  =  -I1
      SUM  =  FC
C
C  PERFORM INTEGRATION
C  CHECK FOR END POINTS BEING ABOVE (PNLN), AND CALC. AREA IF SO BY
C  USING LINEAR EXTRAPOLATION.
      IF  (PNL(1) .LE. PNLN)  GO TO 80
      IF  (PNL(2) - PNL(1))  160, 160, 60
   60 TN  =  TCX(T(1), T(2), PNL(1), PNL(2))
      DT  =  T(1) - TN
      C3  =  C1 * (PNL(1) - PNLN)
   70 SUM  =  SUM + A(CO)
      IF  (I)  80, 100, 100
   80 TX  =  -TX
      IF  (PNL(N) .LE. PNLN)  GO TO 100
      J  =  N - I1
      I  =  I + I1
      IF  (PNL(J) - PNL(N))  160, 160, 90
   90 TX  =  TCX(T(J), T(N), PNL(J), PNL(N))
      DT  =  TX - T(N)
      C3  =  C1 * (PNL(N) - PNLN)
      GO TO 70
  100 CONTINUE
C
C  LOOP OVER ALL POINTS AND SUM AREAS IF ABOVE (PNLN)
      DO  140  J = I2,N
```

```
      I  =  J - I1
      A  =  PNL(I) .GT. PNLN
      B  =  PNL(J) .GT. PNLN
      IF  (A .AND. B)  GO TO 110
      IF  (B .AND. (.NOT. A))  GO TO 120
      IF  (A .AND. (.NOT. B))  GO TO 130
      GO TO 140
  110 DT  =  T(J) - T(I)
      C2  =  EXP(C1 * (PNL(I) - PNLX))
      C3  =  C1 * (PNL(J) - PNL(I))
      SUM  =  SUM + DA(C2)
      GO TO 140
  120 TT  =  TCX(T(I), T(J), PNL(I), PNL(J))
      TN  =  AMIN1(TN, TT)
      DT  =  T(J) - TT
      C3  =  C1 * (PNL(J) - PNLN)
      GO TO 135
  130 TT  =  TCX(T(I), T(J), PNL(I), PNL(J))
      TX  =  AMAX1(TX, TT)
      DT  =  TT - T(I)
      C3  =  C1 * (PNL(I) - PNLN)
  135 SUM  =  SUM + DA(C0)
  140 CONTINUE
  150 SUM  =  SUM / TC
      IF  (SUM .LE. FC)  GO TO 160
      EPNL  =  F10 * ALOG10(SUM) + PNLX
      IGLPNL  =  0
      ANS(1)=EPNL
      ANS(2)=PNLN
      ANS(3)=PNLX
      ANS(4)=TN
      ANS(5)=TX
  160 RETURN
      END
```

```
      SUBROUTINE ERROR(ITYPE,INDX1,INDX2)
C
C  AUTHOR   M.A. JAEGER
C
C PURPOSE             TO WRITE ERROR MESSAGES
C
C  METHOD    THE CALLING SEQUENCE PARAMETERS ARE AS FOLLOWS
C      ITYPE     IDENTIFIES THE NOISE TYPE CURRENTLY BEING PREDICTED
C      INDX1     IDENTIFIES THE ROUTINE IN WHICH THE ERROR WAS FOUND
C      INDX2     IDENTIFIES THE STATEMENT TO BE PRINTED.
C      ERRORS THAT ARE FATAL CAUSE A PROGRAM STOP,OTHERWISE A RETURN TO
C              THE ROUTINE CALLING ERROR AND A RETURN TO ITS CALLING ROUTI
C              WITHOUT CONTINUEING CALCULATION
C
C
C
C
      DIMENSION TYPNAM(4,13)
      DIMENSION SUBNAM(2, 7)
      DATA IOUTAP/ 6/
      DATA SUBNAM/4HATMO,4HSP   ,
     *            4HBLWF,4HLP   ,
     *            4HCOPT,4HR    ,
     *            4HLINC,4HOR   ,
     *            4HPRCP,4H     ,
     *            4HCORS,4HPL      ,
     *           4HMAIN,4H     /
      DATA TYPNAM/4HPRIM,4HARY ,4HJET ,4H     ,
     *            4HPRI.,4HAND ,4HSEC.,4HJET ,
     *            4HCORE,4H AND,4HTURB,4HINE ,
     *            4HCOMP,4H.AND,4HINLT,4H.FAN,
     *            4HEXIT,4H FAN,4H     ,4H    ,
     *            4HAUGM,4HENTO,4HR WI,4HNG   ,
     *            4HBLOW,4HN FL,4HAP   ,4H    ,
     *            4HEJEC,4HTOR ,4HSUPP,4HRESR,
     *            4HLIFT,4H FAN,4H     ,4H    ,
     *            4HPROP,4HELLE,4HR    ,4H    ,
     *            4HHELI,4HCOPT,4HER   ,4H    ,
     *            4HMEAS,4HURED,4H DAT,4HA    ,
     *            4HFLIG,4HHT G,4HEOME, 4HTRY /
      WRITE(IOUTAP,5)(TYPNAM(I,ITYPE),I=1,4)
    5 FORMAT(4H ERR,4HOR D,4HETEC,4HTED ,4HIN P,4HREDI,4HCTIO,4HN OF,4H
     *   ,4A4,4H NOI,4HSE T,4HYPE )
      WRITE(IOUTAP,2010)(SUBNAM(I,INDX1),I=1,2)
 2010 FORMAT(1X,4HERRO,4HR RO,4HUTIN,4HE CA,4HLLED,4H FRO,4HM SU,4HBROU,
     *4HTINE,1X,2A4)
      GO TO (10,20,30,40,50,60,70,80,90,100,110,120,
     *130,140,150,160),INDX2
   10 WRITE(IOUTAP,1010)
      GO TO 2000
   20 WRITE(IOUTAP,1020)
      GO TO 2000
   30 WRITE(IOUTAP,1030)
      GO TO 2000
   40 WRITE(IOUTAP,1040)
      GO TO 2000
   50 WRITE(IOUTAP,1050)
```

```
      GO TO 2000
   60 WRITE(IOUTAP,1060)
      GO TO 2000
70    CONTINUE
      GO TO 2000
   80 WRITE(IOUTAP,1080)
      GO TO 2000
   90 WRITE(IOUTAP,1090)
      GO TO 2000
  100 WRITE(IOUTAP,1100)
      GO TO 2000
  110 WRITE(IOUTAP,1110)
      GO TO 2000
  120 WRITE(IOUTAP,1080)
      GO TO 2000
  130 WRITE(IOUTAP,1130)
      GO TO 2000
  140 WRITE(IOUTAP,1140)
      GO TO 2000
150   WRITE(IOUTAP,1150)
      STOP
  160 WRITE(IOUTAP,1160)
 1010 FORMAT(106HOTOO MANY ENTRIES IN ALTITUDE VS TEMPERATURE TABLE.  MA
     1XIMUM ALLOWED IS FIFTY.  ISA ATMOSPHERE IS ASSUMED.)
 1020 FORMAT(103HOTOO MANY ENTRIES IN ALTITUDE VS PRESSURE TABLE.  MAXIM
     1UM ALLOWED IS FIFTY.  ISA ATMOSPHERE IS ASSUMED.)
 1030 FORMAT(112HOTOO MANY ENTRIES IN ALTITUDE VS RELATIVE HUMIDITY TABL
     1E.  MAXIMUM ALLOWED IS FIFTY.  ISA ATMOSPHERE IS ASSUMED.)
 1040 FORMAT(105HOALTITUDE VS TEMPERATURE TABLE IS UNDEFINED.  MUST HAVE
     1 AT LEAST TWO ENTRIES.  ISA ATMOSPHERE IS ASSUMED.)
 1050 FORMAT(102HOALTITUDE VS PRESSURE TABLE IS UNDEFINED.  MUST HAVE AT
     1 LEAST TWO ENTRIES.  ISA ATMOSPHERE IS ASSUMED.)
 1060 FORMAT(108HOALTITUDE VS RELATIVE HUMIDITY TABLE IS UNDEFINED.  MUS
     1T HAVE AT LEAST TWO ENTRIES.  ISA ATMOSPHERE ASSUMED.)
 1080 FORMAT(40H EFFECTIVE TIP MACH NUMBER OUT OF RANGE,  /
     * 33HGREATER THAN .93 OR LESS THAN 0.        )
 1090 FORMAT(50H TOO MANY TARGET FREQUENCIES SPECIFIED FOR LINING.    /
     *25H ONLY FIRST TEN ARE USED.       )
 1100 FORMAT(69HOTOO MANY WALLS SPECIFIED IN FAN LINING.       ONLY FIRST
     1 TEN ARE USED)
 1110 FORMAT(44HONO WALLS HAVE BEEN DEFINED FOR FAN LINING. )
 1130 FORMAT(1H ,35HERROR WRITING RANDOM FILE JOB ABORT    )
 1140 FORMAT(1H ,35HERROR READING RANDOM FILE JOB ABORT    )
 1150 FORMAT(33HO***FATAL ERROR*** BAD GEOMETRY.    )
 1160 FORMAT(78H *** WARNING *** PROGRAM CAPABILITIES EXCEEDED,I.E. (ME/
     *SF) GREATER THAN ONE      )
 2000 CONTINUE
      RETURN
      END
```

```
      FUNCTION ESHLDG(PSI, BETA, XE)
      DATA F1, HPI, RPD /1.0, 1.570796, 1.745329E-2/
      ESHLDG  =  -10. * ALOG10(XE)
      CP  =  COS(RPD * PSI)
      SP  =  SQRT(F1 - CP*CP)
      IF  (SP .LE. 3.4E-4)  GO TO 10
      CTP  =  F1 + CP / SP
      ESHLDG  =  ESHLDG * (F1 - 2. * (COS(HPI * (BETA / 90.)**0.8)**6) /
     1 (XE * (F1 + CTP*CTP)))
   10 RETURN
      END
```

```
      SUBROUTINE EWGIO
C
C     PURPOSE        TO READ ENGINE/WING GEOMETRY I/O FOR
C                    WING SHIELDING PACKAGE
C
C     INPUT
C         SWPTE      TRAILING EDGE SWEEP ANGLE(DEG) DEFAULT=0.
C         SWPLE      LEADING EDGE SWEEP ANGLE(DEG)          =0.
C         DIHED      WING DIHEDRAL ANGLE(DEG)               =0.
C         DDSD       DIMENSIONLESS DISTANCE BETWEEN ENGINE C.L.
C                    AND WING TIP
C         DDX1D      DIMENSIONLESS DISTANCE IN AXIAL DIRECTION
C                    TO T.E. FROM POINT ON TOP OF WING
C         DDX2D      DIMENSIONLESS DISTANCE IN AXIAL DIRECTION
C                    TO L.E. FROM POINT ON TOP OF WING
C         DDX0D      DIMENSIONLESS DISTANCE IN AXIAL DIRECTION
C                    FROM NOZZLE EXIT PLANE TO POINT ON TOP OF WING DEF=0
C         DDY1D      DIMENSIONLESS DISTANCE NORMAL TO ENGINE C.L.
C                    FROM TOP OF WING TO T.E.
C         DDY2D      DIMENSIONLESS DISTANCE NORMAL TO ENGINE C.L.
C                    FROM TOP OF WING TO L.E.
C         DDY0D      DIMENSIONLESS DISTANCE BETWEEN TOP OF WING
C                    AND ENGINE C.L.  DEFAULT=.1
C         DDLD       DIMENSIONLESS ENGINE LENGTH
C         DIANI      DIAMETER OF NOZZLE INLET (  FT)DEFAULT=.3048
C         DIANE      DIAMETER OF NOZZLE (M,FT)
C
      COMMON/GCONST/IN
      COMMON /GPRAM/ALTP,ALTR,SLOPE,AMACH,NOBS,SLDIST(10),NTENG,IUNIT
C
      COMMON/EWGEO/SWPTE,SWPLE,DIHED,DDSD,DDX1D,DDX2D,DDX0D,
     *DDY1D,DDY2D,DDY0D,DDLD,DIANI,IES
      COMMON/IOPATH/NCAS,NCOF
      DIMENSION WKP(13,3)
      EQUIVALENCE (SEI,IES)
C
      NAMELIST/EWDATA/SWPTE,SWPLE,DIHED,DDX1D,DDX2D,DDX0D,DDSD,
     *DDY1D,DDY2D,DDY0D,DDLD,DIANE,IES
C
C
C
C      TEST AND STORE DATA FOR FIRST CASE
C
       IF( NCAS.EQ.1)GO TO 100
C
C      RESTORE DATA
       SWPTE =WKP( 1,NCOF)
       SWPLE =WKP( 2,NCOF)
       DIHED =WKP( 3,NCOF)
       DDSD  =WKP( 4,NCOF)
       DDX1D =WKP( 5,NCOF)
       DDX2D =WKP( 6,NCOF)
       DDX0D =WKP( 7,NCOF)
       DDY1D =WKP( 8,NCOF)
       DDY2D =WKP( 9,NCOF)
       DDY0D =WKP(10,NCOF)
       DDLD  =WKP(11,NCOF)
```

```
      DIANE =WKP(12,NCCF)
      SEI=WKP(13,NCOF)
  100 READ(IN,EWDATA)
      WKP( 1,NCOF)=SWPTE
      WKP( 2,NCOF)=SWPLE
      WKP( 3,NCOF)=DIHED
      WKP( 4,NCOF)=DDSD
      WKP( 5,NCOF)=DDX1D
      WKP( 6,NCOF)=DDX2D
      WKP( 7,NCOF)=DDX0D
      WKP( 8,NCOF)=DDY1D
      WKP( 9,NCOF)=DDY2D
      WKP(10,NCOF)=DDY0D
      WKP(11,NCOF)=DDLD
      WKP(12,NCOF)=DIANE
      WKP(13,NCOF)=SEI
      DIANI=DIANE
      IF(IUNIT.EQ.0)DIANI=DIANI*3.280833
      RETURN
      END
```

```
      SUBROUTINE EWGOUT(IPRT,IUNIT)
C
C  PURPOSE
C     THIS SUBROUTINE PRINTS THE ENGINE / WING GEOMETRY VARIABLES.
C     THESE VARIABLES ARE AVAILABLE IN COMMON EWGEO.
C     THE PRINTOUT IS ON LOGICAL UNIT 10 UNLESS THE ARRAY REPORT
C     INDICATOR IPRT(7) IS NOT 7 IN WHICH CASE THE PRINTOUT IS ON 6.
C
C  INPUT - CALLING SEQUENCE
C     IPRT   - ARRAY OF REPORT INDICATORS, ONLY 7 IS USED
C     IUNIT  - 0 MKS UNITS
C              1 ENGLISH UNITS
C
C  INPUT - COMMON
C     EWGEO  - ALL VARIABLES ARE PRINTED
C
      DIMENSION IPRT(7)
      COMMON/EWGEO/ SWPTE,SWPLE,DIHED,DDSD,DDX1D,DDX2D,DDXOD,DDY1D,
     1             DDY2D,DDYOD,DOLD,DIANI
      DIMENSION IUD(2)
      DATA IUD /3H M.,3H FT/
C
C     DETERMINE OUTPUT UNIT
C
      IOUT=8
      IF(IPRT(7).NE.7)IOUT=6
C
C     SET THE UNIT FOR DIANI
C
      IF(IUNIT.NE.0)GO TO 25
      IU  =  IUD(1)
      DIANE=DIANI*.3048006
      GO TO 50
   25 IU  =  IUD(2)
      DIANE=DIANI
C
C     PRINT TITLING INFORMATION
C
   50 CALL PRINTH(IPRT(7),LCT,IOUT)
C
C     PRINT THE VARIABLES IN COMMON
C
      WRITE(IOUT,100) SWPTE,DIANE,IU,SWPLE,DOLD,DIHED,DDSD,DDXOD,DDX1D,
     1                DDX2D,DDYOD,DDY1D,DDY2D
  100 FORMAT(1H0,39X,38HE N G I N E / W I N G  G E O M E T R Y //
     1 20X,16HT.E. SWEEP ANGLE,5X,1H=,F6.1,4H DEG,16X,
     2 15HNOZZLE DIA. (D),9X,1H=,F7.2,A3/
     3 20X,16HL.E. SWEEP ANGLE,5X,1H=,F6.1,4H DEG,16X,
     4 19HENGINE LENGTH (L/D),5X,1H=,F7.2/
     5 20X,22HWING DIHEDRAL ANGLE  =,F6.1,4H DEG,16X,
     6 25HDIST. TO WING TIP (S/D) =,F7.2///
     7 41X,37HAXIAL DISTANCE (NOZZLE REL. TO WING)///
     8 21X,8HX0 / D =,F7.2,17X,8HX1 / D =,F7.2,17X,8HX2 / D =,F7.2
     9 ///41X,40HVERTICAL DISTANCES (NOZZLE REL. TO WING)//
     * 21X,8HY0 / D =,F7.2,17X,8HY1 / D =,F7.2,17X,8HY2 / D =,F7.2)
C
      RETURN
```

```
      END                                                               EWGOUT    59
```

```
      SUBROUTINE FAAISO(F,FREQ,K,FC)                                    FAAISO
C     FAAISO   MASTERS,R.M.   APS-1C4A   APRIL 1969                     FAAISO
C       SUBROUTINE FAAISO CALCULATES THE TONE CORRECTION TO A           FAAISO
C       SPECTRUM FROM A KNOWLEDGE OF THE TONAL IRREGULARITIES.          FAAISO
C       THE METHOD IS THAT DEFINED BY THE ISO/FAA CURVES OF REFERENCE 1. FAAISO
C-----     REFERENCE 1.   DEPARTMENT OF TRANSPORTATION, FEDERAL AVIATION FAAISO
C-----                    REGULATIONS, TITLE 14, CHAPTER 1, PART 36   ** FAAISO
C-----                    NOISE STANDARDS- AIRCRAFT TYPE CERTIFICATION ** FAAISO
C-----                    FEDERAL AVIATION ADMINISTRATION, NOV. 3, 1969. FAAISO
C       F------ARRAY OF TONAL IRREGULARITIES                            FAAISO
C       FREQ---ARRAY OF 1/3 OCTAVE BAND FREQUENCIES                     FAAISO
C       K-------NUMBER OF BANDS                                         FAAISO
C       FC-----ARRAY OF TONE CORRECTIONS                                FAAISO
C       TEST FOR FREQUENCY IN THE RANGE 500 TO 5000 HZ AND F IN         FAAISO
C       RANGE OF 3 TO 20DB                                              FAAISO
      DIMENSION F(24),FREQ(24),FC(24)                                   FAAISO
      DO 1I=1,K                                                         FAAISO
      IF(F(I).GE.3.)GO TO 2                                             FAAISO
      FC(I)=0.                                                          FAAISO
      GO TO 1                                                           FAAISO
    2 IF (500..LE.FREQ(I).AND.FREQ(I).LE.5000.)   GO TO  3              FAAISO
C       FREQUENCY NOT IN THE RANGE,TEST FOR VALUE OF F AND FIND FC      FAAISO
      IF (F(I).LT.20.)   GO TO 4                                        FAAISO
      FC(I)=3.3333333333                                                FAAISO
      GO TO 1                                                           FAAISO
    4 FC(I)=F(I)/6.                                                     FAAISO
      GO TO 1                                                           FAAISO
    3 IF (F(I).LT.20.)   GO TO 5                                        FAAISO
      FC(I)=6.6666666666                                                FAAISO
      GO TO 1                                                           FAAISO
    5 FC(I)=F(I)/3.                                                     FAAISO
    1 CONTINUE                                                          FAAISO
      RETURN                                                            FAAISO
      END                                                               FAAISO
```

```
      SUBROUTINE FANNOS(SF,ANGLES,ARRAY,IDCPP,NUMSTG,NINLET,NAFT,NB,FPR,  FANNOS
     *           DIAM,RSS,AREA,RN1,RTS,CRTFPR,DELTA,BPR,NI)               FANNOS
C AUTHOR            D. F. MELDRUM                                          FANNOS
C                                                                          FANNOS
C PURPOSE           TO PREDICT INLET FAN NOISE, AND/OR                     FANNOS
C                   AFT FAN NOISE FOR THE PHASE B NASA-AMES                FANNOS
C   .               FOOTPRINT CONTRACT NAS2-6969.  NOISE IS PREDICTED      FANNOS
C                   AT 150 FEET AS A SINGLE NOISE SOURCE WITHOUT           FANNOS
C                   SHIELDING EFFECTS.                                     FANNOS
C                                                                          FANNOS
C METHOD            AS DESCRIBED IN REFERENCE 1)                           FANNOS
C                                                                          FANNOS
C INPUTS            VIA THE CALL                                           FANNOS
C                                                                          FANNOS
C                   SF          SCALE FACTOR FOR THE DOPPLAR S   FT        FANNOS
C                   ANGLES      DIRECTIVITY ANGLES FOR NOISE PREDICTION    FANNOS
C                                                                          FANNOS
C                   NUMSTG      NUMBER OF FAN STAGES                       FANNOS
C                               1 & NUMSTG & 3                             FANNOS
C                   NINLET      SWITCH FOR INLET FAN NOISE                 FANNOS
C                               PREDICTION IF POSITIVE.                    FANNOS
C                   NAFT        SWITCH FOR AFT FAN NOISE                   FANNOS
C                               PREDICTION IF POSITIVE.                    FANNOS
C                   IDOPP       SWITCH FOR THE DOPPLAR SHIFT               FANNOS
C                               FLIGHT EFFECTS.                            FANNOS
C                               0  NO FLIGHT EFFECTS OR DOPPLAR SHIFT.     FANNOS
C                               1  DOPPLAR SHIFT FOR THE FREQUENCY         FANNOS
C                                  CORRECTION ONLY.                        FANNOS
C                               2  DOPPLAR SHIFT FOR THE FREQUENCY         FANNOS
C                                  AND LEVEL CORRECTION.                   FANNOS
C                   NB(I)       NUMBER OF FAN BLADES FOR EACH STAGE        FANNOS
C                               WHERE 1 & I & NUMSTG                       FANNOS
C                   FPR(I)      FAN PRESSURE RATIO                         FANNOS
C                   DIAM(I)     FAN INLET DIAMETER (INLET ONLY)  FT        FANNOS
C                   RSS(I)      MINIMUM ROTOR/STATOR SPACING               FANNOS
C                   AREA(I)     FAN DISCHARGE AREA (AFT ONLY)      FT*FT   FANNOS
C                   RN1         ROTOR SPEED                        RPM     FANNOS
C                   RTS         RELATIVE TIP MACH NUMBER OF THE            FANNOS
C                               FIRST STAGE WITHOUT INLET GUIDE            FANNOS
C                               VANES (IGV).  IF LESS THAN 1               FANNOS
C                               IGV WILL BE ASSUMED FOR THE FIRST          FANNOS
C                               STAGE (INLET FAN ONLY).                    FANNOS
C                   CRTFPR      FAN PRESSURE RATIO FOR THE                 FANNOS
C                               RELATIVE TIP MACH NUMBER OF                FANNOS
C                               1.025 (INLET FAN ONLY)                     FANNOS
C                   ANGFAN      ENGINE INCLINATION ANGLE                   FANNOS
C                                                                          FANNOS
C                                                                          FANNOS
C OUTPUTS           ARRAY       INLET FAN NOISE PREDICTION FOR 24          FANNOS
C                               FREQUENCIES AT 17 ANGLES AND OR            FANNOS
C                               AFT FAN NOISE PREDICTION FOR 24            FANNOS
C                               FREQUENCIES AT 17 ANGLES                   FANNOS
C                                                                          FANNOS
C                                                                          FANNOS
C REFERENCES        1)  R. J. SAXBY,  NASA-AMES FOOTPRINT CONTRACT         FANNOS
C                       NAS2-6969  FAN NOISE MODULE,   UN-NUMBERED         FANNOS
C                       COORDINATION SHEET,  DATED 19 JANUARY 1973.        FANNOS
```

```
C
C SUBROUTINES         BLZSAW     FANPED     RESCAL
C
C
      DIMENSION NB(3),FPR(3),DIAM(3),RSS(3),AREA(3)
      DIMENSION SF(1),ANGLES(1),       FBPF(3)
      DIMENSION ARRAY(24,17)
      DIMENSION ADTCR1(7),ADTCR3(21),BDTCR1(5),BDTCR3(29),ABBCR1(5),
     *          ABBCR3(13),BBBCR1(5),BBBCR3(29),ARSCRV(10),
     *          CBSCR1(39),CBSCR3(11)
      DATA ADTCR1/3.0,0.1,0.425,1.0,73.0,83.5,83.5/
      DATA ADTCR3/10.0,0.0,20.0,30.0,40.0,50.0,60.0,70.0,80.0,90.0,
     *            100.0,2.0,2.0,1.8,1.5,1.0,0.0,-2.0,-5.0,-10.0,
     *            -16.2/
      DATA BDTCR1/2.0,0.1,1.0,75.5,96.5/
      DATA BDTCR3/14.0,40.0,50.0,60.0,70.0,80.0,90.0,100.0,110.0,120.0,
     *            130.0,140.0,150.0,160.0,170.0,-21.0,-15.0,-9.0,-7.0,
     *            -5.0,-3.0,-1.0,0.0,0.0,-1.0,-4.0,-7.0,-11.0,-15.0/
      DATA ABBCR1/2.0,0.1,1.0,66.0,82.5/
      DATA ABBCR3/6.0,10.0,60.0,70.0,80.0,90.0,100.0,0.0,0.0,-2.0,-5.0,
     *            -10.0,-16.0/
      DATA BBBCR1/2.0,0.1,1.0,73.5,93.5/
      DATA BBBCR3/14.0,40.0,50.0,60.0,70.0,80.0,90.0,100.0,110.0,120.0,
     *            130.0,140.0,150.0,160.0,170.0,-22.0,-16.0,-10.0,-6.0,
     *            -4.0,-2.0,-1.0,0.0,0.0,-2.0,-4.0,-7.0,-12.0,-17.0/
      DATA ARSCRV/2.0,30.0,300.0,10.0,0.0,2.0,30.0,300.0,5.0,0.0/
      DATA CBSCR1/6.0,0.0,.9999,1.0,1.085,1.19,1.435,0.0,0.0,55.0,82.0,
     *            82.0,77.0,6.0,0.0,.9999,1.0,1.135,1.19,1.435,0.0,0.0,
     *            55.0,88.0,88.0,83.0,6.0,0.0,.9999,1.0,1.24,1.295,
     *            1.435,0.0,0.0,55.0,83.0,83.0,80.5/
      DATA CBSCR3/5.0,10.0,50.0,70.0,80.0,100.0,-16.0,0.0,0.0,-2.0,-18./
      DATA ISWTH/1/
      ILEVEL=0
      IDOP=0
      IF(IDOPP.GE.1) IDOP=1
      IF(IDOPP.EQ.1) ILEVEL=1
      IF(ISWTH.EQ.0) GO TO 122
      ISWTH=0
      NUM=ADTCR1(1)
      CALL RESCAL(NUM,ADTCR1(2))
      NUM=ABBCR1(1)
      CALL RESCAL(NUM,ABBCR1(2))
      IAT=1
      NUM=ARSCRV(IAT)
      CALL RESCAL(NUM,ARSCRV(IAT+1))
      IAT=IAT+2*NUM+1
      NUM=ARSCRV(IAT)
      CALL RESCAL(NUM,ARSCRV(IAT+1))
      NUM=BDTCR1(1)
      CALL RESCAL(NUM,BDTCR1(2))
      NUM=BBBCR1(1)
      CALL RESCAL(NUM,BBBCR1(2))
  122 IF(CRTFPR.LE.0.0) CRTFPR=0.0
C
C
      IF(NUMSTG.GT.3) GO TO 600
      IF(NUMSTG.LT.1) GO TO 600
```

```
      IF((NINLET.LE.0).AND.(NAFT.LE.0)) GO TO 600
C
C
  130 FPRCRT=CRTFPR
C
C
C
      NBUZZ=0
      IF(RTS.LT.1.0) NBUZZ=1
      IGV=NBUZZ
      IF(RTS.GT.0.)IGV=0
      DO  200  I = 1,NUMSTG
C
C     CALCULATE THE FUNDAMENTAL BLADE PASSING FREQUENCY.
C
      BLADES=NB(I)
      FBPF(I)=RN1*BLADES/60.0
C
      IF(NINLET.LE.0) GO TO 175
C
C     CALCULATE THE INLET FAN NOISE COMPONENTS.
C
      CRT=FPRCRT
      CALL FANPED(1,CRT,DIAM(I),FPR(I),FBPF(I),RSS(I),SF,ANGLES,
     *              IGV,ILEVEL,IDCP,NI,BFR,DELTA,
     *     ADTCR1,ADTCR3,ABBCR1,ABBCR3,ARSCRV,ARRAY)
      IF(I.NE.1) GO TO 175
      IF(NBUZZ.EQ.0) CALL BUZSAW(RTS,FBPF(I),DIAM(I),SF,
     *                              ANGLES,ILEVEL,IDCP,
     *                              CBSCR1,CBSCR3,ARRAY)
  175 IF(NAFT.LE.0) GO TO 195
      CRT=FPRCRT
C
C     CALCULATE THE AFT FAN NOISE COMPONENTS.
C
      CALL FANPED(0,CRT,AREA(I),FPR(I),FBPF(I),RSS(I),SF,ANGLES,
     *              IGV,ILEVEL,IDCP,NI,BFR,DELTA,
     *BCTCR1,BCTCR3,BBBCR1,BBBCR3,ARSCRV,ARRAY)
  195 FPRCRT=0.0
      IGV=1
  200 CONTINUE
  600 RETURN
      END
```

```
      SUBROUTINE FANPED(ICODE,FPRCRT,DIAM,FPR,FBPF,RSS,XSF,ANGLES,        FANPED
     *                  NIGV,ILEVEL,IDOP,NI,BPR,DELTA,                    FANPED
     *                  DTCR1,DTCR3,BBCR1,BBCR3,RSCRV,SPLOUT)             FANPED
C AUTHOR            D. F. MELDRUM                                        FANPED
C                                                                       FANPED
C                                                                       FANPED
C PURPOSE           TO PREDICT THE DISCRETE TONES AND BROADBAND NOISE   FANPED
C                   COMPONENTS FOR EACH STAGE FOR INLET FAN NOISE OR FOR FANPED
C                   THE AFT FAN NOISE.                                  FANPED
C                                                                       FANPED
C METHOD            THE DISCRETE TONES AND BROADBAND NOISE IS PREDICTED FANPED
C                   FOR THE INLET FAN OR THE AFT FAN                    FANPED
C                   BY THE USE OF CURVES AS PER THE REFERENCE GIVEN.    FANPED
C                   THESE CURVES ARE INTERPOLATED OR EXTRAPOLATED AS    FANPED
C                   NEEDED INORDER TO PREDICT THE NOISE AT 150 FT RADIUS FANPED
C                                                                       FANPED
C INPUTS            ICODE     INDICATOR FOR INLET FAN NOISE OR AFT FAN  FANPED
C                             NOISE. POSITIVE INDICATES INLET FAN NOISE FANPED
C                             OTHERWISE THE AFT FAN IS ASSUMED.         FANPED
C                   FPRCRT    CRITICAL FAN PRESSURE RATIO  USED TO INDIC FANPED
C                             WHETHER OR NOT INLET GUIDE VANES ARE USED FANPED
C                             NOT.  IF LESS THAN OR EQUAL TO ONE NO     FANPED
C                             INLET GUIDE VANES ARE ASSUMED.            FANPED
C                   DIAM      FAN INLET DIAMETER OR AFT NOZZLE AREA     FANPED
C                   FPR       FAN PRESSURE RATIO.                       FANPED
C                   FBPF      FUNDAMENTAL BLADE PASSING FREQUENCY       FANPED
C                   RSS       ROTOR-STATOR SPACING IN PERCENT           FANPED
C                   XSF       SCALE FACTOR FOR THE DOPPLAR SHIFT        FANPED
C                   ANGLES    DIRECTIVITY ANGLES FOR NOISE PREDICTION   FANPED
C                   NIGV      INLET GUIDE VANE SWITCH ON IF             FANPED
C                             SET NON ZERO                              FANPED
C                   ILEVEL    SWITCH FOR THE DOPPLAR SHIFT LEVEL        FANPED
C                             CORRECTION IF NON ZERO                    FANPED
C                   IDOP      SWITCH FOR THE DOPPLAR SHIFT FREQUENCY    FANPED
C                             CORRECTION IF IT SET NON ZERO             FANPED
C                   DTCR1     CURVE - DISCRETE TONES - BASIC DATA       FANPED
C                   DTCR3     CURVE - DISCRETE TONES - DIRECTIVITY ANGLE FANPED
C                   BBCR1     CURVE - BROADBAND - BASIC DATA            FANPED
C                   BBCR3     CURVE - BROADBAND - DIRECTIVITY ANGLE     FANPED
C                   RSCRV     CURVE - ROTOR-STATOR SPACING CORRECTION   FANPED
C                                                                       FANPED
C                   INPUT VIA LABLED COMMON - OFREQ                     FANPED
C                   BANDLM    1/3 OCTAVE BAND LIMITS                    FANPED
C                                                                       FANPED
C OUTPUTS           SPLOUT    TABLE OF PREDICTED NOISE FOR FAN NOISE    FANPED
C                             PREDICTION.  THIS ARRAY MUST BE SET TO    FANPED
C                             ZERO BEFOR PROCESSING EACH CASE.  TO RUN  FANPED
C                             SEVERAL STAGES CALL ONCE FOR EACH STAGE   FANPED
C                             AND THE NOISE FOR EACH STAGE WILL BE ADDED FANPED
C                             TO THIS ARRAY WHICH SHOULD BE ZERO FOR THE FANPED
C                             FIRST STAGE OR WILL HAVE THE SUM OF THE   FANPED
C                             PREVEIOUS STAGES.                         FANPED
C                                                                       FANPED
C MODIFICATIONS     FROM TEE205 INTO TEE215 - THIS WAS TAKEN FROM       FANPED
C                   TEE215 AND CHANGES MADE FOR THE NASA-AMES CONTRACT  FANPED
C                                                                       FANPED
C REFERENCES        COORD SHEET AMEF-M-367  3/17/72  D. MELDRUM  TEE205A FANPED
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C                     ANS-RES-F-327              5/30/72  D. SCHRANK           FANPED
C                     R. J. SAXBY,  NASA-AMES FOOTPRINT CONTRACT               FANPED
C                          NAS2-6969  FAN NOISE MODULE,   UN-NUMBERED          FANPED
C                          COORDINATION SHEET,  DATED 19 JANUARY 1973.         FANPED
C                                                                              FANPED
C FUNCTION SUBPRGM  ALOG10    TBLL1      PWRSUM                                FANPED
C                                                                              FANPED
C                                                                              FANPED
      COMMON /GFREQ/ CFREQ(24),BANDLM(25)                                      FANPED
C                                                                              FANPED
      DIMENSION DTCR1(1),DTCR3(1),BBCR1(1),                                    FANPED
     *          BBCR3(1),RSCRV(1),SPLCLT(24,1)                                 FANPED
      DIMENSION SPL(24),ANGLES(1),XSF(1)                                       FANPED
      DIMENSION CNI(3)                                                         FANPED
C                                                                              FANPED
      DATA CNI/1.0,3.0,6.0/                                                    FANPED
      DATA NANGLE/17/,NFREQ/24/                                                FANPED
C                                                                              FANPED
C                                                                              FANPED
C                                                                              FANPED
C                                                                              FANPED
C     TEST FOR INLET FAN NOISE OR FOR AFT FAN NOISE                            FANPED
C                                                                              FANPED
      IGV=0                                                                    FANPED
      DELTLT=0.                                                                FANPED
      DELTLB=0.                                                                FANPED
      ACON=0.                                                                  FANPED
      IF(ILEVEL.NE.0) ACON=-40.                                                FANPED
C                                                                              FANPED
      IF(ICODE.LE.0) GO TO 50                                                  FANPED
C                                                                              FANPED
C     INLET FAN NOISE                                                          FANPED
C                                                                              FANPED
      SF=20.0                                                                  FANPED
      IF(NIGV.NE.0) IGV=1                                                      FANPED
      GO TO 100                                                                FANPED
C                                                                              FANPED
C     AFT FAN NOISE                                                            FANPED
C                                                                              FANPED
   50 SF=10.0                                                                  FANPED
      IF(NIGV.NE.0) IGV=2                                                      FANPED
C                                                                              FANPED
C                                                                              FANPED
      IF(NI.GT.3) GO TO 100                                                    FANPED
      IF(NI.LE.0) GO TO 100                                                    FANPED
      IF(BPR.GE.10.0) GO TO 100                                                FANPED
      IF(BPR.LE.0.5) DELTLT=-7.8                                               FANPED
      IF(DELTLT.EQ.0.0) DELTLT=6.0*ALOG10(BPR/10.0)                            FANPED
      DELTLT=DELTLT/CNI(NI)                                                    FANPED
      DELTLB=DELTLT*0.5                                                        FANPED
C                                                                              FANPED
C     CALCULATE THE ENGINE SIZE CORRECTION.                                    FANPED
C                                                                              FANPED
  100 SF=SF*ALOG10(DIAM)                                                       FANPED
      ALGFPR=ALOG10(FPR-1.0)                                                   FANPED
C                                                                              FANPED
C     CALCULATE THE BASIC NOISE                                                FANPED
```

```
C
      IX=2
      NUM=DTCR1(1)
      IY=NUM+IX
      DT=TBLU1(ALGFPR,DTCR1(IX),DTCR1(IY),1,NUM)
      IF(NIGV.NE.0) GO TO 105
      IF(ICODE.LE.0) GO TO 105
      IF(FPRCRT.GE.FPR) GO TO 105
C
      ALGCRT=ALOG10(FPRCRT-1.0)
      DT=TBLU1(ALGCRT,DTCR1(IX),DTCR1(IY),1,NUM)
      DT=DT-30.56*(ALGFPR-ALGCRT)
C
  105 DT=DT+SF+DELTLT+DELTA
      NUM=BBCR1(1)
      IY=NUM+IX
      BB=SF+DELTLB+TBLU1(ALGFPR,BBCR1(IX),BBCR1(IY),1,NUM)
C
C     CALCULATE THE ROTOR-STATOR SPACING CORRECTION.
C
      ALGRSS=ALOG10(RSS)
      IZ=2
      NUM=RSCRV(IZ-1)
      IY=NUM+IZ
      RSSDT=TBLU1(ALGRSS,RSCRV(IZ),RSCRV(IY),1,NUM)
      IZ=NUM*2+IZ+1
      NUM=RSCRV(IZ-1)
      IY=NUM+IZ
      RSSBB=TBLU1(ALGRSS,RSCRV(IZ),RSCRV(IY),1,NUM)
      DT=DT+RSSDT
      IF(IGV.EQ.1) DT=DT-6.0
      BB=BB+RSSBB
      IF(IGV.EQ.2) BB=BB+3.
      DO 210 J=1,NANGLE
C
C     IDENTIFY BANDS WITH DISCRETE TONES
C
      DO 110 I=1,NFREQ
  110 SPL(I)=0.0
C
      FREQ=FBPF
      IF(IDOP.NE.0) FREQ=FREQ/XSF(J)
      I1=BANDLM(1)/FREQ
      IF(I1.LE.0) I1=1
      I2=BANDLM(25)/FREQ
      IF(I2.LE.0) GO TO 145
C
      DO 140 I=I1,I2
      FREQ=I
      FREQ=FBPF*FREQ
      IF(IDOP.NE.0) FREQ=FREQ/XSF(J)
      IF(FREQ.LT.BANDLM(1)) GO TO 140
      DO 120 K=1,NFREQ
      IBAND=K
      IF(FREQ.LE.BANDLM(K+1)) GO TO 130
  120 CONTINUE
      GO TO 145
```

```
  130 VALUE= -1
      VALUE= 3.0*VALUE
      IF((I. Q.1).AND.(IGV.NE.C)) VALLE=VALUE+6.
      SPL(IB ND)=PWRSUM(SPL(IBAND),DT+VALUE)
  14C CONTIN E
C
C      IDENTI Y THE REFERENCE BAND FCR BRCACBANC NOISE
C
  145 FREQ=F PF*2.0
      IF( IDO .NE.0) FREQ=FREQ/XSF(J)
  155 AN=10. *ALOG10(FREQ/10C00.0)+24.C
C
C      CALCUL TE THE BASIC SPECTRUM
C
  16C DO 200 I=1,NFREQ
      DTFREQ SPL(I)
      IF(ILE EL.NE.0) DTFREQ=DTFREC-40.0*ALOG10(XSF(J))
      BAND=I
      BAND=B ND-AN
      BBFREC BAND
      IF(BAN .GT.0.0) BBFREQ=-2.0*BAND
      BBFREC BBFREQ+BB
      BBFREQ BBFREQ+ACON*ALOG1C(XSF(J))
C
C      GENERA E TABLE OF NOISE COMPCNENTS
C
      NUM=DT R3(1)
      IY=NUM IX
      DTDATA DTFREQ+TBLU1(ANGLES(J),DTCR3(IX),CTCR3(IY),1,NUM)
      NLM=BB R3(1)
      IY=NUM IX
      BBDATA BBFREQ+TBLU1(ANGLES(J),BBCR3(IX),BBCR3(IY),1,NUM)
      SPLTMP PWRSUM(BBDATA,DTDATA)
      SPLOUT I,J)=PWRSUM(SPLTMP,SPLCLT(I,J))
  20C CONTIN E
  21C CONTIN E
      RETURN
      END
```

```
      SUBROUTINE FLTGEO(IEC)
C
C  ROUTINE TO SOLVE FLIGHT PATH SEGMENT GEOMETRY POINTS FOR CALCULATING
C  NOISE EXTRAPOLATION CORRECTIONS.
C
C
C
C     CONSTANTS USED IN INTERNAL CALCULATIONS
C
      COMMON /GCONST/ IN,IO,II1,II2,FC,F1,F2,F3,F4,F5,F6,F7,F8,F9,F10,
     *                I0,I1,I2,I3,I4,I5,I6,I7,I8,I9,I10,P1,P33,P5,POO1,
     *                EPS,LNDEF,BL,ICC,DFR,RPC,ETA(17),M1,FM1,I17,A,PI
C
C     VARIABLE SET CALCULATED IN THE PROGRAM PROCESSING
C
      COMMON /GCOMON/ NCF,NK,BCF(24),TSFL(24,10,17),SPLT(24,17),
     *BUF(25),RETA(17),SPL2(17),TGAGR(24),CLPSF(17)
C
C     FREQUENCY BANDS USED BY PROGRAM
C
      COMMON /GFREQ/ CFREQ(24),UFREQ(25),PFREQ(24)
C
C     GENERAL INPUT PARAMETERS
C
      COMMON /GPRAM/ ZO,ZR,GRAD,AMACH,L,SLDIST(10),ITENG,IUNIT
     *     ,ISITRM,IATMOS,IAIR,LAIRAB(24),NTEMP,TEMP(50),TALT(50)
     *     ,NPRES,PRES(50),PALT(50),NHUMID,RALT(50),RHUMID(50),CTEMP
     *     ,CPRES,CRHUMD,IEGA,IGUR,DTEMP,DPRES,DHUMID,XKN,NC,FLD(50),
     * ZNR(50),ZNI(50),LINECT,MAXLIN,IPAGE,BCG,TCG,FLR,AALT,EPF
C
C     AIRCRAFT-OBSERVER GEOMETRY OUTPUTS
C
      COMMON /GEOMG/ APY(10,17),APZ(10,17),PD(10,17),DPND(10,17),
     * B1(10,17),B2(10,17),TDS(17,10),TPC(17,10),IRR(10,17)
     *,APF,TP,RHP,APO,TO,RHC,CA,CZ,TSF(17,10),CCV
C
C     CONVERSION CONSTANTS
C
C  INPUTS-
C   A) L=NSLD         NUMBER OF SIDELINE POINTS ON WHICH CALCULATIONS ARE
C                     TO BE BASED -MAXIMUM OF 10
C    SLDIST(1-10)     SIDELINE DISTANCE BETWEEN FLIGHT TRACK AND OBSERVER
C                     ON THE GROUND.
C    ZO = ALTP ..     AIRCRAFT HEIGHT ABOVE THE GROUND WHEN AT (Y=0).
C                     *RESTRICTION* 0. .LE. ZR  LE. ZO
C    ZR =ALTR ...     OBSERVER HEIGHT ABOVE THE GROUND
C                     *RESTRICTION* 0. .LE. ZO
C    GRAD=SLOPE..     CLIMB GRADIENT FOR (Z  GE. ZR).
C
C  OUTPUTS-
C    EACH OUTPUT ARRAY CONSIST OF A MAXIMUM OF 170 ELEMENTS(10 SIDELINE
C    POINTS TIMES 17 ANGLES)
C    APY(10,17)..     AIRCRAFT COORDINATE IN DIRECTION OF FLIGHT PATH
C                     PROJECTION ON THE GROUND.
C    APZ(10,17)..     AIRCRAFT VERTICAL COORDINATE ABOVE THE GROUND.
C    PD(10,17)...     DISTANCE FOR SOUND PROPAGATION.
C     DPND(10,17)     RELATIVE INCREASE IN PATH LENGTH FOR GROUND REFLECTED
```

```
C                       SIGNAL, I.E. DPN = CF / P
C     B1(10,17 ...  ANGLE OF INCIDENCE IN RADIANS CF GROUND REFLECTED
C                   SIGNAL RELATIVE TC GRAZING INCIDENCE.
C     B2(10,17 ...  ELEVATION ANGLE IN RADIANS USED IN EXTRA-GROUND-
C                   ATTENUATION FORMULA.
C     IRR(10,1')..  ERROR CODE
C                    RR = -1 FCR PD= C ANC NOISE LEVELS ARE TC BE SET TO
C                            PLUS INFINITY.
C                       =  0 FCR NC ERRCR DETECTED
C                       =  1 FCR NO SCLUTICN ANC NOISE LEVELS ARE TO BE
C                            SET TO INDEFINITE.
C
C  REMARKS
C    1) OBSER ER COORDINATES ARE (C, C, ZR)
C    2) AIRCR FT COORDINATES ARE (X, Y, Z) EXCEPT WHEN AT THE VISUAL
C       OVERH AD REFERENCE (X, O, ZC).
C    3) Z .GE. ZR. IF AN INITIAL CALCULATICN SHCWS THAT Z .LT. ZR,
C       Z WIL  BE SET TC ZR AND THE CLIMB GRADIENT WILL BE TREATED AS
C       IF IT WERE ZERO.
C..............................................................
      ZRZ=ZR+ ALT
      ZCZ=ZC+ ALT
      CALL AT OSP(ZRZ  ,APP,TP,RHP)
      CALL AT CSP(ZOZ  ,APO,TC,RHC)
      CZ=A*S  T(TO)
      COV=A*  RT(TP)
      CA=P5*(  Z+COV)
      VO=CZ*A  ACH
      DC 20C  J=I1,I17
      DC  2C     I = I1,L
      S2T   =    F! + GRAD*GRAD
      CT   =    F1 / SQRT(S2T)
      S2T   =    (GRAD*GRAD) / S2T
      X=SLDIS (I)
      XS   =    *X
      ZNO   =    ZO - ZR
      IEC=IC
      Y   = -P . * ZNO * S2T
      A1   =    ETA(J)
      SA1   =   SIN(A1)
      T   =   A S(SA1)
      IF   (T    EPS)  12C, 12C, 1C
   10 IF  (AB (T -  F1) - EPS)  25, 2C, 20
   2C TA1   =   TAN(A1)
      Y   =      - CT * SQRT(XS + (ZNC*CT)*(ZNC*CT)) / TA1
   25 ZN   =    NO + Y * GRAD
      IF   (Z     10C, 3C, 3C
   3C ZNS   =   ZN*ZN
      PS   =    S + Y*Y + ZNS
      P   =    RT(PS)
      Z   =      + ZR
      IF   (P   40, 16C, 4C
   4C R   =   -  . * Z * ZR / PS
      IF   (A  (R) - RPC)  5C, 6C, 5C
   5C DPN   =   SQRT( F1 - R) -  F1
      GC TO
   6C FK   =
```

```
      BK  =  -PS * R
      DPN  =  BK
   70 FK  =  FK + F1
      FTK  =  FK + FK
      BK  =  R * BK * (FTK -  F1) / FTK
      DPN  =  DPN + BK
      IF  (ABS(BK) - EPS*ABS(DPN))  80, 80, 70
   80 ZNP  =  Z + ZR
      B1(I,J)      =  ATAN2(ABS(ZNP), SQRT(PS-ZNS))*DPR
      B2(I,J)      =  ASIN(ABS(ZN / P))*DPR
   90 IRR(I,J)     =   IEC
      APY(I,J)   =  Y
      APZ(I,J)   =  Z
      PD(I,J)    =  P
      DPND(I,J)  =  DPN
      GO TO 1000
  100 ZN  =  F0
      Y  =  F0
      IF  (ABS(T- F1) - EPS)  30, 110, 110
  110 Y  =  -X / TA1
      IF  (ABS(GRAD) .LT. EPS)  GO TO 30
      T  =  -ZNO / GRAD
      IF  (ABS(T) .GT. ABS(Y))  Y = T
      GO TO 30
  120 ZN  =  F0
      Y  =  F0
      IF  (ABS(X) - EPS)  130, 130, 150
  130 IF  (ABS(GRAD) - EPS)  30, 140, 140
  140 Y  =  -ZNO / GRAD
      GO TO 30
  150 IEC  =  I1
      GO TO 90
  160 IEC  = M1
      GO TO 90
 1000 CONTINUE
      IF(VC)1800,1700,1800
 1700 TPD(J,I)=UNDEF
      TSP(J,I)=UNDEF
      TDS(J,I)=UNDEF
      GO TO 2000
 1800 DZ=APZ(I,J)-Z0
      DS=SIGN(SQRT(APY(I,J)*APY(I,J)+DZ*DZ),APY(I,J))
      TDS(J,I)=DS/VC
      TPD(J,I)=PD(I,J)/CA+TDS(J,I)
      TSP(J,I)=PD(I,J)/CA
      IF(J.EQ.I1) GO TO 1820
      TSP(J,I)=TSP(J,I)+ABS(DSL-DS)/VC
      GO TO 1830
 1820 DSL=DS
 1830 CONTINUE
 2000 CONTINUE
      RETURN
      END
```

```
      SUBROUTINE  FOTCNT(X,Y,VNOISE,FPATH,AREA,NP,NL,NDIM,TITLE)
C
C
C AUTHOR                K.D. JOHNSON
C PURPOSE               TO PLOT NOISE FOOTPRINT CONTOURS WITHIN A SPECIFIED
C                       PLOT AREA WITH COORDINATE TRANSFORMATION SUCH THAT
C                       X GRAPH = Y PLOTTER
C                       Y GRAPH = X PLOTTER
C
C METHOD                SCALE X-VERTICAL AND Y-HORIZONTAL TO UNITS/CM
C                       DRAW CONTINUOUS CONTOURS IF POINT TO POINT PROJECTIO
C                       REMAINS IN PLOT AREA. AXIS ARE DRAWN TO INTERSECT
C                       AT POINT (0,0).
C
C INPUTS                X         ARRAY OF VERTICAL PLOT COORDINATES
C                                 X(NP,LR,NL) WHERE LR=1(RIGHT),LR=2(LEFT)
C                                 OF FLIGHT PATH
C                       Y         ARRAY OF HORIZONTAL PLOT COORDINATES
C                       VNOISE    ARRAY OF NOISE LEVEL VALUES
C                       AREA      ARRAY OF AREAS UNDER CONTOURS
C                       FPATH     ARRAY OF FLIGHT PATH COORDINATES
C                       NP        NUMBER OF DATA POINTS EACH SIDE OF CONTOUR
C                       NL        NUMBER OF NOISE LEVEL CONTOURS
C                       NDIM      TOTAL LENGTH OF X,Y,FPATH FIRST DIMENSION
C
C  DIMENSIONS FOR INPUT ARRAYS
C
      DIMENSION TEMP(200)
      DIMENSION X(NDIM,2,5),Y(NDIM,2,5),AREA(5),VNOISE(5),FPATH(NDIM,2)
C
C 360
C     COMMON /PLT/ SCALV,YLENM,XLENM,CMFIN ,LABELX(10),LABELY(10),
C    1 AXUNIT,NLABEL(2),SCALU,IWRITE
C     DIMENSION XY(4,2),TITLE(18)
C
      COMMON /PLT/ SCALV,YLENM,XLENM,CMFIN ,LABELX( 4),LABELY( 4),
     1 AXUNIT,NLABEL(1),SCALU,IWRITE
      DIMENSION XY(4,2),TITLE( 8)
C  SCALV MAY BE SET BY USER. IF NOT SCALV WILL BE COMPUTED
C  YLENM,XLENM MUST BE SET TO MAXMUM OVERALL PLOT DIMENSIONS(IN DUMITS)
      EQUIVALENCE (X1,XY(1,1)),(X2,XY(2,1)),(XL,XY(3,1)),(XP,XY(4,1)),
     1 (Y1,XY(1,2)),(Y2,XY(2,2)),(YL,XY(3,2)),(YP,XY(4,2))
      INTEGER BLANK,AXUNIT
      INTEGER UP,DOWN
      LOGICAL IWRITE
      DATA ZERO/0.0/
      DATA BLANK/4H    / ,BLNK/4H    /
      DATA RADIAN/57.29577/
C
C  INITIALIZE
      UP=3
      DOWN=2
      DELTV=0.
      XMIN=10.E10
      YMIN=10.E10
      SCALU=SCALV
C SET BORDERS IN CENTIMETERS
```

```
      BOTTM=3.
      TOP=2.
      SIDE=2.
C
C INITIALIZE IARROW TO PLOT SYMBOL CODE FOR ARROWHEAD
      IARROW=6
C
C SET CHARACTER HEIGHT FOR LEGEND
      CHRHT=.10
C
C  SET MAXIMUM LENGTHS OF X AND Y AXIS IN CM UNITS
C
C ALLOW FOR BORDERS
      XLEN=FLOAT(INT(XLENM-TOP-BOTTM))
      YLEN=FLOAT(INT(YLENM-2.*SIDE))
C
C  COMPUTE SCALE AND FIND MINIMUM AND MAXIMUM PLOT VALUES
      K=1
      XN  =  X(1,1,1)
      DO 20 I=1,2
      DO 20 J=1,NP
      TEMP(K)=X(J,I,1)
      IF  (XN .GT. TEMP(K))  XN = TEMP(K)
      K=K+1
20    CONTINUE
      K=NP*2
      CALL SCALE(TEMP,XLEN,K,1)
      DELTV= TEMP(K+2)
      XMIN= TEMP(K+1)
C  SCALE  Y AXIS
C
      K=1
      YN  =  Y(1,1,1)
      DO 30 I=1,2
      DO 30 J=1,NP
      TEMP(K)= Y(J,I,1)
      IF  (YN .GT. TEMP(K))  YN = TEMP(K)
      K=K+1
30    CONTINUE
      K=NP*2
      CALL SCALE(TEMP,YLEN,K,1)
      DELTV= AMAX1(DELTV,TEMP(K+2))
      YMIN=TEMP(K+1)
      IF  (SCALU)  90, 95, 90
   90 XMIN  =  XN
      YMIN  =  YN
      GO TO 99
   95 SCALU  =  DELTV
   99 WRITE (6,1000) TITLE, XLEN, YLEN, SCALU, AXUNIT, DELTV, AXUNIT,
     *                SCALU, AXUNIT
1000  FORMAT(1H1,29X,8A10//50X,28HNOISE FOOTPRINT CONTOUR PLOT //39X,
     *20HPLOT DIMENSIONS (CM),11X,3HX =,F3.0,3H CM/70X,3HY =,F3.0,3H CM
     *//39X,7HSCALE =,1PE10.3,1X,A4,3H/CM,6X,15HCOMPUTED      =,E10.3,
     *1X,A4,3H/CM /70X,15HUSER SELECTED =,E10.3,1X,A4,3H/CM)
      XP=SCALU/DELTV
      IF(XP.GT.4..OR.XP.LT..25) WRITE(6,1001)
1001  FORMAT(1H0,57X,15H*** WARNING ***//55X,19HUSER SELECTED SCALE/
```

```
     *55X,25HTOO SMALL OR TOO LARGE TO/55X,27HPRODUCE COMPREHENSIVE PLOT FOTCNT
     *S  )                                                              FOTCNT
      DELTV=SCALL                                                       FOTCNT
C                                                                       FOTCNT
C XMON-YMIN MUST BE IN WHOLE CM INCREMENTS                              FOTCNT
      XMIN=FLOAT(IFIX((XMIN-DELTV)/DELTV))*DELTV                        FOTCNT
      YMIN=FLOAT(IFIX((YMIN-DELTV)/DELTV))*DELTV                        FOTCNT
C                                                                       FOTCNT
31    XMAX=DELTV*XLEN+ XMIN                                             FOTCNT
      YMAX=DELTV*YLEN+ YMIN                                             FOTCNT
      WRITE(6,1005) AXUNIT,XMIN,XMAX,YMIN,YMAX                          FOTCNT
1005  FORMAT(1H0,39X,17HPLOT BOUNDARIES (,A4,1H),8X,11HX MINIMUM =      FOTCNT
     *1PE10.3/70X,11HX MAXIMUM =,E10.3//70X,11HY MINIMUM =,E10.3/70X,   FOTCNT
     *11HY MAXIMUM = ,E10.3 )                                           FOTCNT
C                                                                       FOTCNT
C IF  WRITE FLAG ON PRINT CONTOURS                                      FOTCNT
C                                                                       FOTCNT
      IF(IWRITE) GO TO 35                                               FOTCNT
      DO 32 I=1,NL                                                      FOTCNT
      WRITE(6,1006) TITLE                                               FOTCNT
C 360                                                                   FOTCNT
C1006 FORMAT(1H1,29X,18A4)                                              FOTCNT
1006  FORMAT(1H1,29X,8A10)                                              FOTCNT
      WRITE(6,1002) VNOISE(I),NLABEL,AXUNIT                             FOTCNT
C 360                                                                   FOTCNT
C1002 FORMAT(1H0,48X,11HCONTOUR AT ,F5.0,1X,2A4,1X,2HIN,1X,A4//         FOTCNT
 1002 FORMAT(1H0,50X,F5.0,1X,A8,11HCONTOUR IN ,A4//                     FOTCNT
     1 41X,4HLEFT,33X,5HRIGHT  )                                        FOTCNT
      WRITE(6,1003) (X(J,1,I),Y(J,1,I),X(J,2,I),Y(J,2,I),J=1,NP)        FOTCNT
 1003 FORMAT(26X,1PE13.3,3X,E13.3,10X,2E16.3)                           FOTCNT
      WRITE(6,1004) AREA(I),AXUNIT                                      FOTCNT
 1004 FORMAT(///40X,28HTOTAL AREA WITHIN CONTOUR = ,1PE11.4,5H SQ. ,A4) FOTCNT
32    CONTINUE                                                          FOTCNT
C                                                                       FOTCNT
C POSITION PLOTTER                                                      FOTCNT
C                                                                       FOTCNT
35    YP=1./CMPIN                                                       FOTCNT
      CALL PLOT(0.,-10.,-3)                                             FOTCNT
      CALL PLOT(0.,YP,-3)                                               FOTCNT
      XP=SIDE/CMPIN                                                     FOTCNT
      YP=BOTTM/CMPIN                                                    FOTCNT
      CALL PLOT(XP,YP,-3)                                               FOTCNT
C  PLOT AND LABEL AXIS WITH CM TIC MARKS                                FOTCNT
C Y AXIS TO CROSS X AXIS AT (0,0)                                       FOTCNT
      DELCM=DELTV*CMPIN                                                 FOTCNT
      XP=ZERO                                                           FOTCNT
      YP=ZERO                                                           FOTCNT
      IF(XMIN.GE.ZERO)GO TO 40                                          FOTCNT
      YP=-XMIN/DELTV                                                    FOTCNT
40    YMOVIN=YP/CMPIN                                                   FOTCNT
C PLOT Y AXIS                                                           FOTCNT
C                                                                       FOTCNT
C 360                                                                   FOTCNT
C     I=10                                                              FOTCNT
      I=4                                                               FOTCNT
42    IF(LABELY(I).NE.BLANK)GO TO 44                                    FOTCNT
      I=I-1                                                             FOTCNT
```

```
      GO TO 42                                                          FOTCNT
C  360                                                                  FOTCNT
C44   NC=I*4                                                            FOTCNT
44    NC=I*10                                                           FOTCNT
      CALL CMAXIS(0., YP ,LABELY,-NC ,YLEN,0.0,YMIN,DELTV)              FOTCNT
C                                                                       FOTCNT
C                                                                       FOTCNT
C X AXIS TO CROSS Y AXIS AT (0,0)                                       FOTCNT
      YP=ZERO                                                           FOTCNT
      IF(YMIN.GE.ZERO)GO TO 45                                          FOTCNT
      XP= -YMIN/DELTV                                                   FOTCNT
45    XMOVIN=XP/CMPIN                                                   FOTCNT
C                                                                       FOTCNT
C PLOT X AXIS                                                           FOTCNT
C     I=10                                                              FOTCNT
      I=4                                                               FOTCNT
46    IF(LABELX(I).NE.BLANK)GO TO 48                                    FOTCNT
      I=I-1                                                             FOTCNT
      GO TO 46                                                          FOTCNT
C 360                                                                   FOTCNT
C48   NC=I*4                                                            FOTCNT
48    NC=I*10                                                           FOTCNT
      CALL CMAXIS(XP,0.,LABELX,NC,XLEN,90.,XMIN,DELTV)                  FOTCNT
C                                                                       FOTCNT
C  START PLOTTING CONTOURS                                              FOTCNT
C                                                                       FOTCNT
C  INITIALIZE                                                           FOTCNT
      L=0                                                               FOTCNT
50    L=L+1                                                             FOTCNT
      IGO=0                                                             FOTCNT
      IF(L.GT.NL)GO TO 100                                              FOTCNT
      ISIDE=1                                                           FOTCNT
      IBEG=1                                                            FOTCNT
      IEND=NP                                                           FOTCNT
      IPEN=UP                                                           FOTCNT
      INC=1                                                             FOTCNT
60    J=IBEG                                                            FOTCNT
      IGO=IGO+1                                                         FOTCNT
61    XP=X(J,ISIDE,L)                                                   FOTCNT
      YP=Y(J,ISIDE,L)                                                   FOTCNT
C                                                                       FOTCNT
C  DO NOT PLOT POINT IF OUT OF RANGE                                    FOTCNT
C                                                                       FOTCNT
      IF((XP.LT.XMIN.OR.XP.GT.XMAX).OR.(YP.LT.YMIN.OR.YP.GT.YMAX))      FOTCNT
     1 GO TO 75                                                         FOTCNT
      IF(IPEN.EQ.DOWN) GO TO 64                                         FOTCNT
      IF(J.EQ.IBEG) GO TO 64                                            FOTCNT
C  POINT IN RANGE BUT PREVIOUS POINT WAS OUT                            FOTCNT
C  IF NOT FIRST POINT MOVE PEN TO BORDER AND PLOT TO POINT WITH PEN DOWN FOTCNT
C                                                                       FOTCNT
      XA=XL                                                             FOTCNT
      YA=YL                                                             FOTCNT
610   XLIM=ZERO                                                         FOTCNT
      YLIM=ZERO                                                         FOTCNT
      IF(XA.LT.XMIN) XLIM=XMIN                                          FOTCNT
      IF(XA.GT.XMAX) XLIM=XMAX                                          FOTCNT
      IF(YA.LT.YMIN) YLIM=YMIN                                          FOTCNT
```

```
      IF(YA.GT.YMAX) YLIM=YMAX
C
C  FIND POINT AT WHICH CONTOUR INTERSECTS PLOT BORDER
C
      X1=XLIM
      X2=XLIM
      Y1=YLIM
      Y2=YLIM
      IF(XLIM.NE.ZERO) GO TO 62
      X1=XMIN
      X2=XMAX
62    IF(YLIM.NE.ZERO) GO TO 63
      Y1=YMIN
      Y2=YMAX
63    CALL INTRCP(XY,XO,YO,IERR)
      IF(IERR.GT.0) GO TO 620
      XO=(XO-XMIN)/DELCM
      YO=(YO-YMIN)/DELCM
C
C  MOVE PEN TO BORDER INTERSECT WITH PEN IN CURRENT POSITION
C
      CALL PLOT(YO,XO,IPEN)
620   IF(IPEN.EQ.UP) GO TO 630
C  PEN WAS DOWN - RAISE PEN - SKIP OUT OF RANGE POINT
C
640   IPEN=UP
      XL=XP
      YL=YP
      GO TO 65
C
C  PEN WAS UP - GO PLOT FROM BORDER TO POINT
C
630   IPEN=DOWN
C
C  SCALE TO CM AND CONVERT TO PLOT INCHES
C
64    XL=XP
      YL=YP
      XP=(XP-XMIN)/DELCM
      YP=(YP-YMIN)/DELCM
      CALL PLOT(YP,XP,IPEN)
      IPEN=DOWN
65    J=J+INC
      IF(J.GT.0.AND.J.LE.NP)GO TO 61
C
C  PLOT CONTOURS RIGHT TO LEFT,  LEFT TO RIGHT TO MAXIMIZE PLOTTER
C  EFFICIENCY
      GO TO(71,72,73,50),IGO
71    IBEG=NP
      IEND=1
      ISIDE=2
      INC=-1
      GO TO 80
72    IBEG=1
      IEND=NP
      ISIDE=2
      INC=1
```

```
      IPEN=UP
      L=L+1
      IF(L.GT.NL)GO TO 100
      GO TO 60
73    IBEG=NP
      IEND=1
      ISIDE=1
      INC=-1
      GO TO 80
75    IF(IPEN.EQ. UP ) GO TO 640
C  CURRENT POINT OUT OF RANGE - LAST POINT IN
C  PLOT TO BORDER WITH PEN DOWN
C
      XA=XP
      YA=YP
      GO TO 610
80    IF(IPEN.EQ.UP) GO TO 60
      IPEN=UP
      IF(XP.EQ.X(IBEG,ISIDE,L)/DELCM.AND.YP.EQ.Y(IBEG,ISIDE,L)/DELCM)
     1 IPEN=DOWN
      GO TO 60
C
C  ALL NOISE LEVELS PLOTTED
C
C PLOT FLIGHT PATH AS SERIES OF ARROW HEADS POINTING IN DIRECTION
C OF FLIGHT
C
100   XL= ZERO
      YL=.0001
      DO 120 I=1,NP
      XP=FPATH(I,1)
      YP=FPATH(I,2)
      IF((XP.LT.XMIN.OR.XP.GT.XMAX).OR.(YP.LT.YMIN.OR.YP.GT.YMAX))
     1GO TO 110
      A=XP-XL
      B=YP-YL
      THETA=ASIN(A/SQRT(A**2+B**2))*RADIAN
      IF(B.GE.ZERO) THETA=THETA-90.
      XPP=(YP-YMIN)/DELCM
      YPP=(XP-XMIN)/DELCM
      CALL SYMBOL(XPP,YPP,.04,IARROW,THETA,-1)
110   XL=XP
      YL=YP
120   CONTINUE
C
C  DRAW TITLE AT TOP OF PAGE
C
      XP=(XLEN+1.)/CMPIN
C 360
C     I=18
      I=8
125   IF(TITLE(I).NE.BLNK) GO TO 130
      I=I-1
      IF(I.LE.0) GO TO 130
      GO TO 125
130   IF(I.EQ.0) GO TO 135
C 360
```

```
C       I=I*4
        I=I*10
        YP  =  .5 * (YLEN / CMPIN - .16 * FLOAT(I))
        CALL SYMBOL(YP,XP,.16,TITLE,0.0,I)
135     CONTINUE
C
C LABEL CONTOURS AT 1/3 TOTAL RANGE ON LEFT SIDE
C
        IP= NP/3
        DO 150 I=1,NL
        FPN= VNOISE(I)
        XP=(Y(IP,2,I)-YMIN)/DELCM
        YP=(X(IP,2,I)-XMIN)/DELCM
        CALL NUMBER(XP,YP,CHRHT,FPN,0.0,-1)
        XP  =  XP + CHRHT * FLOAT(MCHAR(FPN))
        CALL SYMBOL(XP,YP,CHRHT,NLABEL,0.0,8)
150     CONTINUE
C
C DRAW LEGEND
C ALL PEN MOVEMENTS COMPUTED IN INCHES
C
        XL=YLEN/CMPIN-2.
        YP=-CHRHT
        CALL SYMBOL(XL,YP,CHRHT,7HCONTCLR,0.0,7)
        XP=XL+1.1
        CALL SYMBOL(XP,YP,CHRHT,4HAREA,0.0,4)
        YP=YP-.15
        CALL SYMBOL(XL,YP,CHRHT,NLABEL,0.0,8)
        XP=XL+1.0
        CALL SYMBOL(XP,YP,CHRHT,3HSQ.,0.0,3)
        XP=XL+1.4
        CALL SYMBOL(XP,YP,CHRHT,AXUNIT,0.0,4)
        DO 175 I=1,NL
        FPN=VNOISE(I)
        XP  =  XL + .4 - CHRHT * FLOAT(MCHAR(FPN))
        YP=YP-.20
        CALL NUMBER(XP,YP,CHRHT,FPN,0.0,-1)
        FPN=AREA(I)
        IP=MCHAR(FPN)-1
        FPN=FPN/10.**IP
        XP=XL+ 1.0
        CALL NUMBER(XP,YP,CHRHT,FPN,0.0,3)
        XP  =  XP + 5. * CHRHT
        CALL SYMBOL(XP,YP,CHRHT,1HE,0.0,1)
        XP=XP+CHRHT
        FPN=IP
        CALL NUMBER(XP,YP,CHRHT,FPN,0.0,-1)
175     CONTINUE
C
C DRAW SCALE ANNOTATION IN FAR RIGHT CORNER
        XP=XL
        YP=YP-.25
        CALL SYMBOL(XP,YP,CHRHT,11HSCALE=1 CM/ ,0.0,11)
        NC=MCHAR(DELTV)+1
        XP=XL+11.*CHRHT
        CALL NUMBER(XP,YP,CHRHT,DELTV,0.0,-1)
        XP  =  XP + CHRHT * FLOAT(NC)
```

```
      CALL SYMBOL(XP,YP,CHRHT,AXUNIT,0.0,4)
C
C PAGE UP PAPER
C  ALLOW 2 INCHES BETWEEN PLOTS
C
      XP=(YLEN+SIDE)/CMPIN+2.
      YP=       -BOTTM/CMPIN
      CALL PLOT(XP,YP,-3)
      RETURN
      END
```

```
      SUBROUTINE FTPRT(N,DATN,N4,D1,D2,D3,D4,IMODE,NLN)                  FTPRT
C      PURPOSE      TO PREPARE A NOISE CONTOUR SCHEME WITH PARAMETERS     FTPRT
C      ENGINE PRESSURE RATIO, OFF AXIS RANGE, NOISE LEVEL AND ELEVATION.  FTPRT
C                                                                         FTPRT
C        NLS    STARTING NOISE CONTOUR                                    FTPRT
C        NLF    LAST NOISE CONTOUR TO BE EXAMINED                         FTPRT
C     METHOD   THE DATA IS READ IN AND CONVERTED TO A FUNCTION            FTPRT
C        LOG(RO)=FUN(EPR,Z,NL) ARRANGED INTO TABLES OF LOG(RO) VALUES     FTPRT
C        FOR EACH SPECIFIC NOISE LEVEL TO BE EXAMINED. THEN FOR EACH      FTPRT
C        SET OF FLIGHT PARAMETERS, TABLE LOOK UP ROUTINES ARE USEDTO GET  FTPRT
C        THE VALUEOF LOG(RO) FOR EACH NOISE LEVEL. THE X, Y AND           FTPRT
C        DIFFERENTIAL AREA CAN THEN BE CALCULATED FROM ONE POINT TO       FTPRT
C        THE SUCCESSIVE POINT AND STORED AS A SUM FOR EACH NOISE LEVEL.   FTPRT
      COMMON/VALNL/NLST,NLFT                                             FTPRT
      COMMON/SIZE/NLRO,NALFA                                             FTPRT
      COMMON/COUNT/NEPR,NL                                               FTPRT
      COMMON/CONTNT/AEPR(6),ALRO(9),AALFA(6)                             FTPRT
      DIMENSION X1(5),X2(5),Y1(5),Y2(5),SUM(5)                           FTPRT
      DIMENSION SLNL(3)                                                  FTPRT
      DIMENSION DATN(1),D1(1),D2(1),D3(1),D4(1)                          FTPRT
      CALL DATAIN(N,DATN,N4,D1,D2,D3,D4,IMODE)                           FTPRT
      IF(IMODE.NE.-1) GO TO  1000                                        FTPRT
      NLS=NLST                                                           FTPRT
      NLF=NLFT                                                           FTPRT
      CALL VDIM(D1,D2,NEPR,NL,NLRO,NALFA,NLS,NLF)                        FTPRT
      RETURN                                                             FTPRT
 1000 CONTINUE                                                           FTPRT
C     DATAIN READS IN THE APPROPRIATE DATA VIA DATA STATEMENTS THEN      FTPRT
C     SORTS AND FINDS THE DISTINCT VALUES OF THE INPUTS FROM TEE 187     FTPRT
      CALL DRIVES(D1,D2,X1,X2,Y1,Y2,SUM,SLNL,IMODE)                      FTPRT
C     DRIVER IS A TEMPORARY SUBROUTINE TO SIMULATE THE OUTPUT OF THE     FTPRT
C     SIMULATOR BY SUPPLYING SAMPLE FLIGHT COORDINATES                   FTPRT
      RETURN                                                             FTPRT
      END                                                                FTPRT
```

```
      COMPLEX FUNCTION FW(W)
C
C  COMPUTES BOUNDARY LOSS FACTOR
C
      COMPLEX W, X, A, S
      DIMENSION XP(2), AP(2), SP(2)
      REAL K
      DOUBLE PRECISION AA(2), SS(2), T1, T2, T
      EQUIVALENCE (XP(1),X), (AP(1),A), (SP(1),S)
      DATA ZERO,ONE,P5,EPS,PI,I1 /0.,1.,-.5,1.2E-7  ,3.1415926535898,1/
      K  =  ZERO
      X  =  W
      XX  =  XP(1)*XP(1) + XP(2)*XP(2)
      IF  (XX - 100.)  100, 200, 200
C
C  SERIES FORM NO.1, ARG MAG .LT. 10.
  100 AA(1)  =  ONE
      AA(2)  =  ZERO
      SS(1)  =  ONE
      SS(2)  =  ZERO
  101 K  =  K + ONE
      T   =  K + K
      T  =  (T - ONE) / ((T + ONE) * K)
      T1  =  AA(1)
      T2  =  AA(2)
      AA(1)  =  T * (T1 * XP(1) - T2 * XP(2))
      AA(2)  =  T * (T1 * XP(2) + T2 * XP(1))
      AP(1)  =  AA(1)
      AP(2)  =  AA(2)
      SS(1)  =  SS(1) + AA(1)
      SS(2)  =  SS(2) + AA(2)
      SP(1)  =  SS(1)
      SP(2)  =  SS(2)
      AX  =  ABS(AP(1)) + ABS(AP(2))
      SX  =  ABS(SP(1)) + ABS(SP(2))
      IF  (AX - EPS * SX)  102, 102, 101
  102 FW  =  ONE - CEXP(-X) * ((X+X) * S - (0.,1.) * CSQRT(PI * X))
      GO TO 300
C
C  CONTINUED FRACTION FORM NO.2, ARG MAG .GE. 10.
  200 A = P5/ (X -2.5 -3./ (X -4.5 -7.5/ (X -6.5 -10.803/ (X -4.269))))
      FW  =  (P5 + A) / (X + P5 + A)
  300 RETURN
      END
```

```
      SUBROUTINE GRDRFX(F,NFB,ITONE,R,DRN,BO,CO,KN,ND,LOF,ZNR,ZNI,DSPL)   GRDRFX
C                                                                         GRDRFX
C  ROUTINE TO COMPUTE GROUND REFLECTION CORRECTIONS (DSPL) TO BE ADDED     GRDRFX
C  TO FREE-FIELD ACOUSTIC SPECTRA IN ORDER TO OBTAIN THE EFFECT OF A      GRDRFX
C  REFLECTING GROUND PLANE. (11 MAY 1972 BY D.G. DUNN)                    GRDRFX
C                                                                         GRDRFX
C  REFERENCE                                                              GRDRFX
C  1) P.B. ONCLEY,/PROPAGATION OF JET ENGINE NOISE NEAR A POROUS          GRDRFX
C     SURFACE/, JOURNAL OF SOUND AND VIBRATION, VOL13, C1970, PP27-35.    GRDRFX
C  2) D.G. DUNN, /COMPUTER MODULE FOR GROUND REFLECTION EFFECTS/,         GRDRFX
C      BOEING COORDINATION SHEET ANS-RES-F-321, MAY 1972                  GRDRFX
C                                                                         GRDRFX
C  INPUTS                                                                 GRDRFX
C   1) F      ... ARRAY OF FREQUENCIES (HZ) TO BE USED IN THE CALCULA-    GRDRFX
C                 TION. *RESTRICTION* F .GT. ZERO AND IF (ITONE .LE. 0)   GRDRFX
C                 THE CORRECTIONS ARE ASSUMED TO APPLY TO BROAD-BAND,     GRDRFX
C                 CONSTANT-PERCENTAGE-BAND SPECTRA. THE VALUES FOR (F)    GRDRFX
C                 ARE THE GEOMETRIC-MEAN FREQUENCIES FOR THE PASS BANDS,  GRDRFX
C                 POSITIVE (NON-ZERO), AND ORDERED IN MONOTONIC INCREA-   GRDRFX
C                 SING VALUE.                                             GRDRFX
C   2) NFB    ... NUMBER OF FREQUENCIES OR LEVELS TO BE CORRECTED.        GRDRFX
C                 *RESTRICTION* IF (ITONE .GT. 0) NFB .GE. 1, OTHERWISE   GRDRFX
C                                                 NFB .GE. 2              GRDRFX
C   3) ITONE  ... INDICATOR TO SPECIFY THE TYPE OF SPECTRA.               GRDRFX
C                 ITONE .LT. 0 FOR BROAD-BAND, CONSTANT-PERCENTAGE-BAND   GRDRFX
C                              SPECTRA INTEGRAL EQUATION 8B OF REF.2      GRDRFX
C                 ITONE .EQ. 0 FOR SAME EXCEPT USE APPROXIMATION EQ.8C    GRDRFX
C                 ITONE .GT. 0 FOR TONES OR POWER SPECTRAL DENSITY        GRDRFX
C                              TYPE LEVELS. SEE EQ.8A OF REF.2            GRDRFX
C                                                                         GRDRFX
C   4) R      ... DISTANCE FOR PROPAGATION (DIRECT PATH) IN FEET.         GRDRFX
C   5) DRN    ... RELATIVE PATH LENGTH DIFFERENCE FOR REFLECTED SIGNAL,   GRDRFX
C                 IE. DRN = DR/R                                          GRDRFX
C   6) BO     ... INCIDENT ANGLE FOR REFLECTED SIGNAL IN DEGREES.         GRDRFX
C                                                                         GRDRFX
C  INPUTS VIA COMMON BLOCK /BLK98/                                        GRDRFX
C   7) CO     ... SPEED OF SOUND (FT/SEC) OVER PROPAGATION PATHS.         GRDRFX
C   8) KN     ... MAGNITUDE OF WAVE NUMBER RATIO, IE. KN = ABS(K1/KO),    GRDRFX
C                 KO = 2*PI * F / CO, K1 = KO * (A + I*B) FOR GROUND.     GRDRFX
C                 *RESTRICTION* KN .GT. 0.                                GRDRFX
C   9) ND     ... NUMBER OF DATA POINTS FOR THE GROUNDS NORMALIZED-       GRDRFX
C                 COMPLEX IMPEDANCE CURVE.                                GRDRFX
C                 *RESTRICTION*  3 .LE. ND .LE. 50                        GRDRFX
C  10) LOF    ... ARRAY OF VALUES, LOG10(F), FOR THE IMPEDANCE DATA       GRDRFX
C                 CURVE, Z1/ZO VERSUS LOG10(F).                           GRDRFX
C  11) ZNR    ... ARRAY OF DIMENSIONLESS  IMPEDANCE VALUES (REAL PART)    GRDRFX
C                 FOR THE DATA CURVE, IE. ZNR=RE(Z1/ZO)                   GRDRFX
C                 *RESTRICTION* ZNR .GE. ZERO                             GRDRFX
C  12) ZNI    ... SAME EXCEPT THE IMAGINARY PARTS, IE. ZNI=IM(Z1/ZO)      GRDRFX
C                                                                         GRDRFX
C  OUTPUT                                                                 GRDRFX
C  13  DSPL   ... ARRAY OF SPL CORRECTIONS. (DB)                          GRDRFX
C                                                                         GRDRFX
C  REMARKS                                                                GRDRFX
C    1) REQUIRES ROUTINES- DPSD, FW, CPOLAR, TBLU1, TERP1, SEARCH         GRDRFX
C                                                                         GRDRFX
C.....................................................................   GRDRFX
```

```
      DOUBLE PRECISION S1, S2
      REAL KN, LDF
      DIMENSION F(1), DSPL(1), AP(2)
      DIMENSION LDF(1),ZNR(1),ZNI(1)
      COMPLEX CPOLAR, SB1, A
      COMPLEX ZN,RP,W,FX
      COMMON/BLK97/ZN,RP,W,FX
      EQUIVALENCE (AP(1),A)
      DATA ONE,ZERO,TEN,EPS,OMEGA,RPD /1.,0.,10.,1.E-3,750.,
     * 1.745329251943E-2 /
C
   10 SBO  =  BO*RPD
      CBO  =  COS(SBO)
      SBO  =  SIN(SBO)
      CB1  =  CBO / KN
      SB1S  =  ONE - CB1*CB1
      IF  (SB1S)  11, 12, 12
   11 SB1  =  CMPLX(ZERO,-SQRT(-SB1S))
      GO TO 13
   12 SB1  =  CMPLX(SQRT(SB1S), ZERO)
   13 IF  (ITONE)  20, 20, 40
   20 ETA  =  (F(NFB) / F(1))**(.5 / FLOAT(NFB - 1))
      IF  (ITONE .GE. 0)  GO TO 80
      SRF  = 7.07 * (R * DRN / CO) * (ETA - ONE / ETA)
      DO  30  K = 1,NFB
      FL  =  F(K) / ETA
      FU  =  F(K) * ETA
      NSR  =  AMAX1(3.0, SRF * F(K)) + 0.5
      N1  =  NSR+NSR
      FN1  =  N1
      DX  =  (FU - FL) / FN1
      S1  =  ZERO
      N1  =  N1 - 1
      DO  21  J = 1,N1,2
      FTEM=FL+FLOAT(J)*DX
      STEM=DPSD(FTEM,SBO,CBO,SB1,A,SB1S,R,DRN,CO,KN,LDF,ZNR,ZNI,ND)
      S1=S1+STEM
   21 CONTINUE
      S2  =  ZERO
      N1  =  N1 - 1
      DO  22  J = 2,N1,2
      FTEM=FL+FLOAT(J)*DX
      STEM=DPSD(FTEM,SBO,CBO,SB1,A,SB1S,R,DRN,CO,KN,LDF,ZNR,ZNI,ND)
      S2=S2+STEM
   22 CONTINUE
      STEM=DPSD(FL   ,SBO,CBO,SB1,A,SB1S,R,DRN,CO,KN,LDF,ZNR,ZNI,ND)
      FTEM=DPSD(FU   ,SBO,CBO,SB1,A,SB1S,R,DRN,CO,KN,LDF,ZNR,ZNI,ND)
      S = (STEM    +FTEM     + 4.D0*S1 + S2+S2) / (3. * FN1)
      DSPL(K)  =  TEN * ALOG10(S)
   30 CONTINUE
      GO TO 100
   40 DO  70  K = 1,NFB
      S    =DPSD(F(K),SBO,CBO,SB1,A,SB1S,R,DRN,CO,KN,LDF,ZNR,ZNI,ND)
      IF  (S)  50, 50, 60
   50 DSPL(K)  =  -OMEGA
      GO TO 70
   60 DSPL(K)  =  TEN * ALOG10(S)
```

```
   70 CONTINUE
      GO TO 100
   80 FU  =  3.1415926535896 * R * DRN / CO
      FL  =  FU * (ETA - ONE / ETA)
      FU  =  FU * (ETA + ONE / ETA)
      DO  90  K = 1,NFB
      P1  =  FL * F(K)
      P2  =  FU * F(K)
      S   =DPSD(F(K),SB0,CBC,SB1,A,SB1S,R,DRN,CO,KN,LDF,ZNR,ZNI,ND)
      A  =  CPOLAR(A)
      S = ONE+AP(1)*AP(1) + (AP(1)+AP(1)) * COS(P2-AP(2)) * SIN(P1)/P1
      DSPL(K)  =  TEN * ALOG10(S)
C     IF(R.NE.150.)GO TO 90
C     AP(2)=AP(2)/RPD
C     WRITE(6,120)F(K),DSPL(K),ZN,A,RP,W,FX
  120 FORMAT(3X2F9.1,1PE11.3,9E11.3)
   90 CONTINUE
  100 RETURN
      END
```

```
      SUBROUTINE INITL
C
C     INPUT DATA BLOCKS FOR NOISE COMPONENTS
C     ITYPE DEFINES THE TYPE OF NOISE COMPONENT
C ITYPE=1  PRIMARY JET
C   =2      PRIMARY AND SECONDARY JET
      COMMON/JETDAT/NJET1,MCODE1,AP1,WF1,VP1,AS2,WS2,VS2,PR1,PA1,
     1     TT1,VA1,DIAMJ1,ANGJT1,ICOR1
C   =3      CORE AND TURBINE
      COMMON/COREIN/TT3,PP3,CMF3,EK3,DELT3,JB3,
     *  ICOR3,LIN3,NTF3,IMA3,LGM3,NWL3,ICP3,ILAY3,TF3(10),
     *  PCTA3(10),PLA3(10),ELCH3,ECH3,FIW3(10),TL3(10),CF3,FM3
C   =4      COMPRESSOR AND INLET FAN
C   =5      EXIT FAN
C   =6      AUGMENTER-WING JET
      COMMON/SWITCH/NTYPE,ITYPE,NENG,ICCF,IPRT(7),ICN(13),NLCPT
      COMMON/AUGWNG/GAMA6,TT6,NPR6,DELT6,AD6,DE6,
     *  ICOR6,LIN6,NTF6,IMA6,LGM6,NWL6,ICP6,ILAY6,TF6(10),
     *  PCTA6(10),PLA6(10),ELCH6,ECH6,FIW6(10),TL6(10),CF6,FM6
C   =7      BLOWN-FLAP JET
C   =8      EJECTOR - SUPPRESSOR JET
C   =9      LIFT-FAN
C   =10     PROPELLER
      COMMON/PROPIN/T10,W10,RPM10,D10,CSUB10,ASUB10,B10,DELT10,
     *ICOR10
C   =11     HELICOPTER AND TILT ROTOR
      COMMON/COPTER/T11,Q11,RPM11,B11,CT11,AB11,DE11,RN11,
     1        S11,CEE11,DELT11,XLMC11,XMM11,NRTR11,LLF11,
     *IRR11,ICOR11
C
C     THIS ROUTINES FUNCTION IS TO INSURE CORRECT INITIALIZATION
C     BEFORE EACH DATA CASE IS STARTED
C         INFORMATION DESCRIBING THE DATA CASE  (HEADING INFORMATION)
C
C     CONSTANTS USED IN INTERNAL CALCULATIONS
C
      COMMON /GCONST/ IN,IO,IT1,IT2,F0,F1,F2,F3,F4,F5,F6,F7,F8,F9,F10,
     *                I0,I1,I2,I3,I4,I5,I6,I7,I8,I9,I10,P1,P33,P5,P001,
     *                EPS,UNDEF,BL,ICD,CPR,RPD,ETA(17),M1,FM1,I17,A,PI
C
C     VARIABLE SET CALCULATED IN THE PROGRAM PROCESSING
C
      COMMON /GCOMON/ NCF,NK,BCF(24),TSPL(24,10,17),SPLT(24,17),
     *BUF(25),RETA(17),SPL2(17),TGAGR(24),DCPSF(17)
C
C     FREQUENCY BANDS USED BY PROGRAM
C
      COMMON /GFREQ/ CFREQ(24),UFREQ(25),FFREQ(24)
C
C     GENERAL INPUT PARAMETERS
C
      COMMON /GPRAM/ALTP,ALTF,SLOPE,AMACH,NOBS,SLDIST(10),NTENG,IUNIT
     *     ,ISPTRM,IATMOS,IAIR,UAIRAB(24),NTEMP,TEMP(50),TALT(50)
     *     ,NPRES,PRES(50),PALT(50),NHUMID,RALT(50),RHUMID(50),CTEMP
     *     ,CPRES,CRHUMD,IEGA,IGDR,DTEMP,DPRES,DHUMID,XKN,NC,FLO(50),
     * ZNR(50),ZNI(50),LINECT,MAXLIN,IPAGE,BCC,TCG,FLR,AALT,FPF,ISFE
C
```

```
C     AIRCRAFT-OBSERVER GEOMETRY OUTPUTS
C
      COMMON /GEOMO/ APY(10,17),APZ(10,17),PD(10,17),DPND(10,17),
     * B1(10,17),B2(10,17),TDS(17,10),TPD(17,10),IRR(10,17)
     *,APP,TP,RHP,APO,TO,RHO,CA,CZ,TSP(17,10),COV
C
C     CONVERSION CONSTANTS
C
      COMMON/GCONVC/C(2,10),SLDISX(10)
      COMMON/CRSPLS/DOB(17),PSCR(17),DPB(408),NPSCR
C
      COMMON/ICPATH/NCAS,NCCF,NTYP,IC,NRN,IARRAY(2)
      COMMON  /HEAD/ HIN(20),HOUT(20),CHIN(20)
      COMMON/SUMSPL/SSPL(24,10,17)
      REWIND 8
      REWIND 9
      REWIND 10
      REWIND 12
      DO 50 I=1,24
      DO 50 J=1,10
      DO 50 K=1,17
 50   SSPL(I,J,K)=F0
      DO 100 I=1,13
 100  ICN(I)=I0
      ISFE = I0
      IF(NCAS.NE.I0)GO TO 2000
      CEE11=24.4
      XMM11=2.0
      XLMC11=30.0
      RN11=0.8
      LLF11=2
      S11=5.0
      REWIND 20
      NC=3
      ZNR(1)=3.7
      ZNR(2)=3.7
      ZNR(3)=3.7
      ZNI(26)=11.7
      ZNI(27)=4.0
      ZNI(28)=-3.7
      FLD(26)=100.
      FLD(27)=1000.
      FLD(28)=10000.
      DO 200 I=1,20
      HIN(I)=8L
      HOUT(I)=8L
 200  CHIN(I)=8L
      DO 300 I=1,17
 300  RETA(I)=ETA(I)*RPD
      RETURN
 2000 DO 400 J=1,17
 400  COPSF(J)=F1
      RETURN
      END
```

```
      SUBROUTINE INLET                                                      INLET
C AUTHOR              D. F. MELDRUM                                         INLET
C                                                                           INLET
C PURPOSE             TO PREDICT INLET FAN NOISE FOR THE PHASE B            INLET
C                     NASA-AMES FOOTPRINT CONTRACT NASA-6969.               INLET
C                                                                           INLET
C METHOD              AS DESCRIBED IN REFERENCE 1).                         INLET
C                                                                           INLET
C INPUTS              VIA LABLED COMMON FANDAT                              INLET
C                                                                           INLET
C                     NUMSTG    NUMBER OF FAN STAGES                        INLET
C                               1 & NUMSTG & 3                              INLET
C                     NINLET    SWITCH FOR INLET FAN NOISE                  INLET
C                               PREDICTION IF POSITIVE.                     INLET
C                     NAFT      SWITCH FOR AFT FAN NOISE                    INLET
C                               PREDICTION IF POSITIVE.                     INLET
C                     IDOPP     SWITCH FOR THE DOPPLAR SHIFT                INLET
C                               FLIGHT EFFECTS.                             INLET
C                               0  NO FLIGHT EFFECTS OR DOPPLAR SHIFT.      INLET
C                               1  DOPPLAR SHIFT FOR THE FREQUENCY          INLET
C                                  CORRECTION ONLY.                         INLET
C                               2  DOPPLAR SHIFT FOR THE FREQUENCY          INLET
C                                  AND LEVEL CORRECTION.                    INLET
C                     NB(I)     NUMBER OF FAN BLADES FOR EACH STAGE         INLET
C                               WHERE 1 & I & NUMSTG                        INLET
C                     FPR(I)    FAN PRESSURE RATIO                          INLET
C                     DIAM(I)   FAN INLET DIAMETER (INLET ONLY)  FT         INLET
C                     RSS(I)    MINIMUM ROTOR/STATOR SPACING     PERCENT    INLET
C                     AREA(I)   FAN DISCHARGE AREA (AFT ONLY)    FT*FT      INLET
C                     RN1       ROTOR SPEED                      RPM        INLET
C                     RTS       RELATIVE TIP MACH NUMBER OF THE             INLET
C                               FIRST STAGE WITHOUT INLET GUIDE             INLET
C                               VANES (IGV).  IF LESS THAN 1                INLET
C                               IGV WILL BE ASSUMED FOR THE FIRST           INLET
C                               STAGE (INLET FAN ONLY).                     INLET
C                     CRTFPR    FAN PRESSURE RATIO FOR THE                  INLET
C                               RELATIVE TIP MACH NUMBER OF                 INLET
C                               1.025 (INLET FAN ONLY)                      INLET
C                     ANGFAN    ENGINE INCLINATION ANGLE                    INLET
C                                                                           INLET
C                     VIA LABLED COMMON SWITCH                              INLET
C                                                                           INLET
C                     NUMENG    NUMBER OF NOISE SOURCES OF THE SAME         INLET
C                               NOISE TYPE.                                 INLET
C                                                                           INLET
C                     VIA LABLED COMMON GCOMON                              INLET
C                                                                           INLET
C                     NOF       1/3 OCTAVE OF FULL OCTAVE SWITCH            INLET
C                               OR NUMBER OF FREQUENCY BANDS (8 OR 24)      INLET
C                     RETA(24)  DIRECTIVITY ANGLES                          INLET
C                                                                           INLET
C                     VIA LABLED COMMON GPRAM                               INLET
C                                                                           INLET
C                     AMACH     MACH NUMBER OF THE AIRCRAFT                 INLET
C                     NOBS      NUMBER OF OBSERVER POSITIONS                INLET
C                                                                           INLET
C                     VIA LABLED COMMON SUMSPL                              INLET
```

```
C
C                      SSPL      CURRENT TOTAL PREDICTED NOISE FOR NCF
C                                (8 OR 24) FREQUENCIES, AT NOBS OBSERVER
C                                POSITIONS FOR 17 DIRECTIVITY ANGLES.
C
C                      VIA LABLED COMMON ANGLE (SET UP BY SUBROUTINE ANGLES
C
C                      PSI       17 DIRECTIVITY ANGLES FOR EACH OF
C                                NOBS OBSERVER POSITIONS.
C                      PSIO      17 DIRECTIVITY ANGLE PROJECTIONS FOR
C                                EACH OF NOBS OBSERVER POSITIONS
C                      BETA      ELEVATION ANGLE PROJECTION FOR EACH
C                                OF NOBS OBSERVER POSITIONS.
C
C                      EACH COMPONENT IS WRITTEN ON TAPE OR FILE 10
C                      FOR EACH OF NCF BANDS FOR EACH OF NOBS OBSERVER
C                      POSITIONS.
C
C OUTPUTS              VIA LABLED COMMON SUMSPL
C
C                      SSPL      CURRENT TOTAL PREDICTED NOISE FOR
C                                8 OR 24 FREQUENCIES, AT NOBS OBSERVER
C                                POSITIONS FOR 17 DIRECTIVITY ANGLES.
C
C                      VIA LABLED COMMON ANGLE (SET UP BY SUBROUTINE ANGLES
C
C                      PSI       17 DIRECTIVITY ANGLES FOR EACH OF
C                                NOBS OBSERVER POSITIONS.
C                      PSIO      17 DIRECTIVITY ANGLE PROJECTIONS FOR
C                                EACH OF NOBS OBSERVER POSITIONS
C                      BETA      ELEVATION ANGLE PROJECTION FOR EACH
C                                OF NOBS OBSERVER POSITIONS.
C
C
C REFERENCES           1)  R. J. SAXBY,  NASA-AMES FOOTPRINT CONTRACT
C                          NAS2-6969  FAN NOISE MODULE,   UN-NUMBERED
C                          COORDINATION SHEET,  DATED 19 JANUARY 1973.
C
C FUNCTION SUBPRGM     COS       ESHLDC      PWRSUM
C
C SUBROUTINES          ANGLES    UNIT        FANNCS     ZERO
C
C
C
C
C
C
      COMMON /FANDAT/ NUMSTG,NINLET,NAFT,IDCPP,NB(3),FPR(3),
     *                DIAM(3),RSS(3),AREA(3),RN1,RTS,CRTFPR,ANGFAN,
     *NI5,BPR5,ICOR4,LIN4,NTF4,IMA4,LGM4,NWL4,IDP4,ILAY4,TF4(10),
     *PCTA4(10),PLA4(10),ELDH4,EDH4,R1W4(10),TL4(10),CF4,FM4,
     *ICOR5,LIN5,NTF5,IMA5,LGM5,NWL5,IDP5,ILAY5,TF5(10),
     *PCTA5(10),PLA5(10),ELDH5,EDH5,R1W5(10),TL5(10),CF5,FM5
      COMMON/SWITCH/NTYPE,ITYPE,NENG,IDCP,IPRT(7),ICN(13),NLLPT
     *,INSEOW(3),INSHLD
C     CONSTANTS USED IN INTERNAL CALCULATIONS
C
```

```
      COMMON /GCONST/ IN,IO,IT1,IT2,FC,F1,F2,F3,F4,F5,F6,F7,F8,F9,F10,
     *                I0,I1,I2,I3,I4,I5,I6,I7,I8,I9,I10,P1,P33,P5,P001,
     *                EPS,UNDEF,BL,ICC,CFR,RPD,ETA(17),M1,FM1,I17,A,PI
C
C     VARIABLE SET CALCULATED IN THE PROGRAM PROCESSING
C
      COMMON /GCOMCN/ NCF,NK,BCF(24),TSPL(24,10,17),SPLT(24,17),
     *BUF(25),RETA(17),SPL2(17),TGAGR(24),DCPSF(17)
      COMMON/SUMSPL/SSPL(24,10,17)
      COMMON/PNLD/PSPL(17,20),EPNL(5,10),TEPNL(5,10)
C
C     FREQUENCY BANDS USED BY PROGRAM
C
      COMMON /GFREQ/ CFREQ(24),UFREC(25),PFREC(24)
C
C     GENERAL INPUT PARAMETERS
      COMMON/ANGLE/PSI(17,10),PSIO(17,10),BETA(17,10)
C
      COMMON /GPRAM/ALTP,ALTR,SLOPE AMACH,NOBS,SLDIST(10),ITENG,IUNIT
     *     ,ISPTRM,IATMOS,IAIR,LAIRAB(2,4),NTEMP,TEMP(50),TALT(50)
     *     ,NPRES,PRES(50),PALT(50),NHUMID,RALT(50),RHUMID(50),CTEMP
     *     ,CPRES,CRHUMD,IEGA,IGOR,CTEMP,CPRES,DHUMIC,XKN,NL,FLD(50),
     * ZNR(50),ZNI(50),LINECT,MAXLIN,IPAGE,BCG,TCC,FLS,AALT,FPF
C
C     AIRCRAFT-OBSERVER GEOMETRY OUTPUTS
C
      COMMON /GEOMO/ APY(10,17),APZ(10,17),PD(10,17),DPND(10,17),
     * B1(10,17),B2(10,17),TDS(17,10),TFD(17,10),IRR(10,17)
     *,APP,TP,RHP,APG,IC,RHC,CA,CZ,TSF(17,10),CCV
C
C     CONVERSION CONSTANTS
C
      COMMON/GCONVC/C(2,10),SLDISX(10)
      COMMON/TMSPL/SPZ(24,17),IB(2,3,13)
      COMMON/UNSHLD/USPLA(19),FSI(19),NUSPL,INUSP
      COMMCN/CRSPLS/DOB(17),PSCR(17),DFB(408),NFSCR
      COMMON/HEAD/HIN(20),HOUT(20),CHIN(20)
C
C
C
      ICN(4)=ICN(4)+1
C
C
      DELTA=ANGFAN*RPD
      CALL ANGLES(NOBS,DELTA)
C
C
C     LOOP FOR THE NUMBER OF OBSERVER POSITIONS
C
      FBPF  =  FLOAT(NB(1)) * RN1 / 60.
C
C     TEST FOR SHIELDING AND EXIT TO PRINT OUT WING
C     SHIELDING DATA ONCE FOR ALL SIDELINE POSITIONS
      IF(INSHLD.NE.0)CALL WSHOUT(IPRT(7),10,ITYPE,USPLA,NUSPL,FSI,INUSP)
   40 DO 1000 M=1,NOBS
      CALL LINCOR(SPZ(1,1),IMA4,LGM4,ELCH4,ECH4,NWL4,R1W4,TL4,
     *     ILAY4,FM4,IDP4,PSI(1,M),NCF,BCF,PLA4,
```

```
     *      CF4,PCTA4,NTF4,TF4,DOPSF,SPL2,ICOR4,IB(1,1,ITYPE),LIN4,FBPF)
C
      CALL ZERO(SPLT,408)
C
C
C
C     CALCULATE THE INLET FAN NOISE PREDICTION
C
      CALL FANNOS(DOPSF, PSI(1,M),SPLT(1,1),IDCP,NUMSTG,1,0,NB,FPR,
     *            DIAM,RSS,AREA,RN1,RTS,CRTFPR,0.0,BPR5,NI5)
C
C
   45 CONTINUE
C
C     CONVERT TO A UNIT OR INDEXED SPECTRA
C
      CALL UNIT(150.,17,SPLT(1,1))
      ENG=NENG
      IF(ENG.LE.0.0) ENG=1.0
      ELVANG=90.0
      DANGLE=-45.0
      ENS=ESHLDG(DANGLE,ELVANG,ENG)
      DO 50 J=1,17
      DO 50 K=1,24
   50 SPLT(K,J)=SPLT(K,J)-ENS
      IF(NCF.EQ.24) GO TO 300
C
C     CONVERT 1/3 OCTAVE TO FULL OCTAVE
C
      DO 200 J=1,17
      DO 200 K=1,8
      TMP  =  0.
      DO 100 L=1,3
      JC   =  3 * K + L - 3
  100 TMP  =  PWRSUM(TMP, SPLT(JC,J))
  200 SPLT(K,J)  =  TMP
C
C
C     ADD TO CURRENT TOTAL AND WRITE ON TAPE 10
C
C
  300 DO 400 J=1,NCF
      DO 400 K=1,17
  400 SPLT(J,K)=SPLT(J,K)-SPZ(J,K)
C
      IF(INSHLD.NE.0)CALL SHLDSP(APACH,ALTR,ISPTRM,CZ,SLDIST,M,
     *APY,APZ,DOPSF,SPLT,NCF,BCF,SPZ,PSI,ITYPE,ANGFAN,XX)
C
      DO 405 J=1,NCF
      DO 405 K=1,17
  405 SSPL(J,M,K)=PWRSUM(SSPL(J,M,K),SPLT(J,K))
      IF(IPRT(7).NE.7)GO TO 410
      CALL NOISO(IPRT(7),M,NK,10,CHIN,ILNIT,SLDISX(M),PFREC,SPLT(1,1),
     *  NCF,ITYPE)
 410  CONTINUE
      DO 360 JC=1,NCF
      DO 360 KC=1,17
```

```
 360  SPLT(JC,KC)=SPLT(JC,KC)-ISPL(JC,M,KC)
      CALL PNLSUB(SPLT(1,1),PSPL(1,M),TFD(1,M),EPNL(1,M),SPL2,
     *TEPNL(1,M),NK,BCG,TCG,FLR,M,NLBS,IRR(M,1))
      IF(IPRT(3).NE.3)GO TO 1000
      CALL NOISC(IPRT(3),M,NK,12,CHIN,ILNIT,SLDISX(M),PFREQ,
     *    SPLT(1,1),NCF,ITYPE)
C
C
C
 1000 CONTINUE
      RETURN
      END
```

```
      SUBROUTINE INPUTG                                                 INPUTG
C                                                                       INPUTG
C     CONSTANTS USED IN INTERNAL CALCULATIONS                           INPUTG
C                                                                       INPUTG
      COMMON /GCONST/ IN,IO,IT1,IT2,F0,F1,F2,F3,F4,F5,F6,F7,F8,F9,F10,  INPUTG
     *                I0,I1,I2,I3,I4,I5,I6,I7,I8,I9,I10,P1,P33,P5,P001, INPUTG
     *                EPS,UNDEF,BL,ICO,DPR,RPD,ETA(17),M1,FM1,I17,A,PI  INPUTG
C                                                                       INPUTG
C     VARIABLE SET CALCULATED IN THE PROGRAM PROCESSING                 INPUTG
C                                                                       INPUTG
      COMMON /GCOMON/ NCF,NK,BCF(24),TSPL(24,10,17),SPLT(24,17),        INPUTG
     *BUF(25),RETA(17),SPL2(17),TGAGR(24),DCPSF(17)                     INPUTG
C                                                                       INPUTG
C     FREQUENCY BANDS USED BY PROGRAM                                   INPUTG
C                                                                       INPUTG
      COMMON /GFREQ/ CFREQ(24),UFREQ(25),PFREQ(24)                      INPUTG
      COMMON/SUMSPL/SSPL(24,10,17)                                      INPUTG
      COMMON/PNLD/PSPL(17,20),EPNL(5,10),TEPNL(5,10)                    INPUTG
      COMMON/ANGLE/PSI(17,10),PSIO(17,10),BETA(17,10)                   INPUTG
C                                                                       INPUTG
C     GENERAL INPUT PARAMETERS                                          INPUTG
C                                                                       INPUTG
      COMMON /GPRAM/ALTP,ALTR,SLOPE,AMACH,NOBS,SLDIST(10),NTENG,IUNIT   INPUTG
     *    ,ISPTRM,IATMOS,IAIR,LAIRAB(24),NTEMP,TEMP(50),TALT(50)        INPUTG
     *    ,NPRES,PRES(50),PALT(50),NHUMID,RALT(50),RHUMID(50),CTEMP     INPUTG
     *    ,CPRES,CRHUMD,IEGA,IGDR,DTEMP,DPRES,DHUMID,XKN,ND,FLL(50),    INPUTG
     * ZNR(50),ZNL(50),LINECT,MAXLIN,IPAGE,BCG,TCG,FLR,AALT,EPP,ISFE    INPUTG
C                                                                       INPUTG
C  WING SHIELDING, JET REFRACTION EMPIRICISMS AND CONDITIONS            INPUTG
      COMMON/REFRAC/EMJ,ISTSO,IWED(3),FASS(24),TETA(24),CPSIG(24),NASRG, INPUTG
     * ASF,IWSFE                                                        INPUTG
      DIMENSION FLD(25),ZNI(25)                                         INPUTG
      EQUIVALENCE (FLD(1),FLL(26)),(ZNI(1),ZNL(26))                     INPUTG
C                                                                       INPUTG
C     AIRCRAFT-OBSERVER GEOMETRY OUTPUTS                                INPUTG
C                                                                       INPUTG
      COMMON /GEOMO/ APY(10,17),APZ(10,17),PD(10,17),DPND(10,17),       INPUTG
     * B1(10,17),B2(10,17),TDS(17,10),TPD(17,10),IRR(10,17)             INPUTG
     *,APP,TP,RHP,APO,TC,RHC,CA,CZ,TSF(17,10),CCV                       INPUTG
C                                                                       INPUTG
C     CONVERSION CONSTANTS                                              INPUTG
C                                                                       INPUTG
      COMMON/GCONVC/C(2,10),SLDISX(10)                                  INPUTG
      COMMON/CRSPLS/DOB(17),PSCR(17),CPB(408),NPSCR                     INPUTG
      COMMON/ICPATH/NCAS,NCOF,NTYP,IC,NPN,IARRAY(2)                     INPUTG
      COMMON/SWITCH/NTYPE,ITYPE,NENG,IOCF,IPRT(7),ICN(13),NLCPT         INPUTG
     *,INSECW(3),INSHLD                                                 INPUTG
C                                                                       INPUTG
      COMMON/HEAD/ HIN(20),HOUT(20),CHIN(20)                            INPUTG
      DIMENSION IOUT(7)                                                 INPUTG
      DATA ALTPG,ALTOG/2*0./                                            INPUTG
      NAMELIST/GDATA/ALTPG,ALTOG,SLOPE,AMACH,NOBS,SLDIST,NTENG,IUNIT,   INPUTG
     *     ISPTRM,IATMOS,IAIR,LAIRAB,NTEMP,TEMP,TALT,NLCPT,ISFE,        INPUTG
     *     NPRES,PRES,PALT,NHUMID,RALT,RHUMID,CTEMP,INSECW,             INPUTG
     *     CPRES,CRHUMD,IEGA,IGDR,DTEMP,DPRES,DHUMID,XKN,ND,FLD,        INPUTG
     *     ZNR,ZNI,LINECT,MAXLIN,IPAGE,BCG,TCG,FLR,AALT,EPP,IOCP,IOUT   INPUTG
C     READ IN CASE HEADING CARD UP TO 80 COLS -ONE CARD AS FIRST INPUT  INPUTG
```

```
C      EACH CASE - SUCEEDING CASE CARDS MAYBE BLANK IF INITIAL HEADING IS
C      THROUGHOUT RUN
C360   READ(IN,1000,END=200)HIN
       READ(IN,1000)HIN
       IF  (EOF(IN))  200, 100
  100  CONTINUE
       IF(NCAS .EQ. 10)GO TO 25
       IF(HIN(I1).EQ.BL.AND.HIN(I2).EQ.BL.AND.HIN(9).
     1      EQ.BL.AND.HIN(10).EQ.BL.AND.HIN(12).EQ.BL)GO TO 60
   25  CONTINUE
       DO 50 I=I1,20
   50  HCUT(I)=HIN(I)
   60  CONTINUE
C      READ IN DATA FOR GENERAL DESCRIPTION OF CASE
       READ(IN,GDATA)
       IWSFE = ISFE
       ALTP=ALTPG
       ALTR=ALTOG
C      ADD  PRINT REPORTS INDICATOR VALUES TO NAMELIST GDATA AND COMMON
C      BLOCK SWITCH
C      THERE ARE 7 DIFFERENT REPORTS AVAILABLE AS OPTIONS PLUS A DEFAULT
C      OPTION. THESE  REPORTS MAY BE REQUESTED BY INPUTING VALUES 1 THRU
C      7 INTO A 7 ELEMENT ARRAY IOUT IN ANY ORDER OR ANY SUBSET DURING
C      THE INITIALIZATION PHASE OF INPUT.  I.E. IOUT(1)=5,7,4,2
C      IN THE ABOVE EXAMPLE 4 TYPES OF REPORTS WOULD BE GENERATED
C      THE FOLLOWING ARE THE 7 TYPES OF REPORTS INDICATED BY A PARTICULAR
C      VALUE
C      =1     TOTAL NOISE AT SIDELINE DISTANCES PLUS NOISE TIME HISTORY
C      =2     ASSUMPTIONS ON WHICH THE PREDICTION IS BASED
C      =3     NOISE AT SIDELINE DISTANCES PER COMPONENT
C      =4     FLIGHT PATH/OBSERVER GEOMETRY
C      =5     EXTRAPOLATION CORRECTIONS
C      =6     TOTAL FREE FIELD NOISE AT (R=1 M)
C      =7     FREE FIELD NOISE AT(R=1 M) PER COMPONENT
C             THE DEFAULT OPTION  PRINTS A REPORT GIVING THE TITLE FOLLOWED
C             BY THE NOISE-TIME HISTORY FOR THE TOTAL NOISE AT EACH SIDELIN
C       PLUS  (=2) THE ASSUMPTIONS
C      SET  UP REPORT OPTIONS FOR PRINTOUT
       DO 125 I=I1,NOBS
  125  SLDISX(I)=SLDIST(I)
       DO 130 I=1,7
  130  IPRT(I)=0
       IPK=0
       DO 160 I=1,7
       DO 150 J=1,7
       IF(IOUT(I).NE .J)GO TO 150
       IPRT(J)=J
       IPK=J
       GO TO 160
  150  CONTINUE
  160  CONTINUE
       IF(IPK.EQ.0)IPRT(1)=8
  170  CONTINUE
C      WRITE(IT1,GDATA)
       RETURN
  200  ICD=I2
       RETURN
```

```
1000 FORMAT(20A4)                                              INPUTG     116
     END                                                       INPUTG     117
```

```
      SUBROUTINE INTRCP(XY,X,Y,IERR)
C
C AUTHOR              K.D. JOHNSON
C
C PURPOSE             TO CALCULATE THE POINT OF INTERSECTION OF 2 LINES
C                     DEFINED BY THE SET OF COORDINATES  XY
C
C METHOD              POINT SLOPE
C
C INPUT               XY         COORDINATE ARRAY WHERE
C                                XY(1)-XY(2) DEFINE END POINTS OF LINE 1
C                                XY(3)-XY(4) DEFINE END POINTS OF LINE 2
C
C OUTPUT              X          X INTERCEPT
C                     Y          Y INTERCEPT
C
C ERROR CODE          IERR       0= INTERCEPT RETURNED
C                                1= NO INTERCEPT POSSIBLE
C
      DIMENSION  XY(4,2)
C
C  INITIALIZE
      IERR=0
      X1=XY(1,1)
      X2=XY(2,1)
      X3=XY(3,1)
      X4=XY(4,1)
      Y1=XY(1,2)
      Y2=XY(2,2)
      Y3=XY(3,2)
      Y4=XY(4,2)
      SAME=.00001
      IGO=1
      T=X2-X1
      IF(ABS(T).LT.SAME) GO TO 10
      S12=(Y2-Y1)/T
      GO TO 12
10    IGO=2
12    T=X3-X4
      IF(ABS(T).LT.SAME) GO TO 60
      S34=(Y3-Y4)/T
      IF  (IGO-1)  25, 25, 50
C
C  COMPUTE INTERCEPT IF SLOPES ARE NOT EQUAL OR INFINITE
C
25    IF(ABS(S12 - S34).LT.SAME) GO TO 90
      X= (Y4 - Y1 + S12*X1 - S34*X4)/(S12 - S34)
30    Y=  S12 * (X - X1) + Y1
      GO TO 99
C
C  COMPUTE INTERCEPT WHERE  X=X1=X2
C
50    X=X1
      IF(ABS(X3-X4).LT.SAME) GO TO 90
      Y= S34 * (X - X4) + Y4
      GO TO 99
C
```

```
C  COMPUTE INTERCEPT WHERE  X=X3=X4
C
60     X=X3
       IF( ABS(X1-X2).LT.SAME) GO TO 90
       GO TO 30
C
C NO INTERCEPT POSSIBLE WITHIN REASONABLE RANGE IF EVER
C
90     IERR=1
C
99     RETURN
       END
```

```
      SUBROUTINE JBES(ARG, N, EPS, BES)
C
C  ROUTINE TO CALCULATE BESSEL FUNCTIONS OF ORDERS (0 THRU N-1).
C
C *NOTE*
C  ASSUMES POSITIVE ARGUMENT AND ORDER N.
      DIMENSION BES(1)
      DATA I1, I2, F0, F1, E0, E1 /1, 2, 0., 1., .02, 5.E-3/
      X  =  ABS(ARG)
      IF  (X - E0)  10, 40, 40
   10 BES(1)  =  F1
      DO  20  K = 1,N
      BES(K+1)  =  F0
   20 CONTINUE
   30 GO TO 90
   40 M  =  X
      DO  50  K = 1,I2
      MP1  =  M + I1
      CALL BESJ(X, M, BES(MP1), EPS, IER)
   50 M  =  MP1
      M  =  X
      IF  (M)  80, 80, 60
   60 DO  70  I = 1,M
      K  =  M + I1 - I
      BES(K)  =  FLOAT(K) * (BES(K+1)+BES(K+1)) / X - BES(K+2)
   70 CONTINUE
   80 M  =  M + I2
      IF  (M - N)  100, 90, 90
   90 RETURN
  100 I  =  -I1
      NM1  =  N + I
      S  =  E1 * (ABS(BES(M-1)) + ABS(BES(M)))
      DO  140  K = M,NM1
      KP1  =  K + I1
      BES(KP1)  =  FLOAT(K-1) * (BES(K)+BES(K)) / X - BES(K-1)
      IF  (ABS(BES(KP1)) - S)  110, 130, 130
  110 IF  (I)  120, 150, 150
  120 I  =  I + I1
      GO TO 140
  130 I  =  -I1
  140 CONTINUE
      GO TO 90
  150 DO  160  I = KP1,NM1
      BES(I+1)  =  F0
  160 CONTINUE
      GO TO 90
      END
```

```
      SUBROUTINE JEINT                                                  JEINT
C                                                                       JEINT
C     PURPOSE  JET/EDGE INTERACTION NOISE PREDICTION                    JEINT
C              FOR AN ENGINE OVER WING CONFIGURATION                    JEINT
C              THE PROCEDURE IS BASED ON THEORETICAL                    JEINT
C              AND EMPIRICAL ANAYSIS SHOWN IN THE BOEING REFERENCES     JEINT
C     REF.     FILLER, PREDICTION SCHEME FOR ENGINE JET EXHAUST         JEINT
C              FLOW-WING/FLAP INTERACTION NOISE ANS-RES-670 DEC 74      JEINT
C              DUNN, A/C CONFIGURATION NOISE REDUCTION CONTRACT         JEINT
C              DOT-FA74WA-3497,PROGRESS REPORT 7 FEB 75                 JEINT
C                                                                       JEINT
C     INPUT                                                             JEINT
C              AJS13  JET SPREADING ANGLE (DEG).DEFAULT=5.7             JEINT
C              DDA13  DIMENSIONLESS DISCHARE AREA.DEFAULT=.7854         JEINT
C              DDNE13 DIMENSIONLESS DISTANCE BETWEEN NOZZLE EXIT        JEINT
C                     TO THE WING/FLAP SYSTEMS TRAILING EDGE            JEINT
C              DHNL13 DIMENSIONLESS NOZZLE LIP HEIGHT ABOVE WING SURFACE JEINT
C              DJCL13 DIMENSIONLESS JET CORE LENGTH. DEFAULT=5.0        JEINT
C              EMJ13  JET MACH NUMBER                                   JEINT
C              FLAP13 NOMINAL FLAP ANGLE ANGLE OF ATTACK                JEINT
C              HD13   HYDRAULIC DIAMETER OF JET NOZZLE (M OR FT)        JEINT
C              TSR13  JET STATIC TEMPERATURE RATIO                      JEINT
C              ICOR13 =0 INDICATES NO CONFIGURATION CORRECTIONS         JEINT
C                     =1 CORRECTIONS ARE A FUNCTION OF DIRECTIVITY      JEINT
C                     =2 CORRECTIONS ARE A FUNCTION OF DIRECTIVITY      JEINT
C                        AND FREQUENCY                                  JEINT
C                                                                       JEINT
C     INPUT    GENERAL                                                  JEINT
C              ALTR   OBSERVER HEIGHT ABOVE GROUND                      JEINT
C              AMACH  A/C MACH NO                                       JEINT
C              APO    AMBIENT PRESSURE AT A/C ALTITUDE                  JEINT
C              APY    A/C COORDINATE IN DIRECTION OF FLIGHT PATH        JEINT
C                     PROJECTED ON THE GROUND                           JEINT
C              APZ    A/C HEIGHT ABOVE GROUND                           JEINT
C              BCF    GEOMETRIC MEAN FREQUENCIES FOR SPECTRA            JEINT
C              CZ     AMBIENT SPEED OF SOUND AT A/C ALTITUDE            JEINT
C              DOPSF  DOPPLER SHIFT FACTOR                              JEINT
C              ISPTPM FILTER BANDWIDTH INDEX 1=FULL,IF 0=1/3 O/B SPL    JEINT
C              NCF    NUMBER OF CENTER FREQ.                            JEINT
C              NENG   NO OF ENGINES                                     JEINT
C              NOBS   NUMBER OF OBSERVER POSITIONS                      JEINT
C              SLDIST SIDE LINE DISTANCE                                JEINT
C              SLOPE  A/C CLIMB GRADIENT                                JEINT
C                                                                       JEINT
C     OUTPUT   SPLT   FINAL SOUND PRESSURE LEVEL ,1/1 OR 1/3 O/B SPECTRA JEINT
C                     AT EACH DIRECTIVITY ANGLE POSITION,FREE FIELD R=1M JEINT
C              SSPL   THE SUM OF SPLT AT EACH OBSERVER POSITION         JEINT
C                                                                       JEINT
      COMMON/JETEDG/AJS13,DDA13,DDNE13,DHNL13,DJCL13,                   JEINT
     *FLAP13,HD13,EMJ13,TSR13,ICOR13                                    JEINT
C                                                                       JEINT
C     VARIABLE SET CALCULATED IN THE PROGRAM PROCESSING                 JEINT
C                                                                       JEINT
      COMMON /GCOMON/ NCF,NK,BCF(24),TSPL(24,10,17),SPLT(24,17),        JEINT
     *BUF(25),BETA(17),SPLZ(17),TGAGR(24),DOPSF(17)                     JEINT
C                                                                       JEINT
      COMMON/GCONVC/C(2,10),SLDISX(10)                                  JEINT
```

```
C
C     GENERAL INPUT PARAMETERS
C
      COMMON/ANGLE/PSI(17,10)
      COMMON /GPRAM/ALTP,ALTR,SLOPE,AMACH,NOBS,SLDIST(10),NTENG,IUNIT
     *    ,ISPTRM,IATMOS,IAIR,LAIRAB(24),NTEMP,TEMP(50),TALT(50)
     *    ,NPRES,PRES(50),PALT(50),NHUMID,RALT(50),RHUMID(50),CTEMP
     *    ,CPRES,CRHUMD,IFGA,IGDR,DTEMP,DPRES,DHUMID,XKN,NC,FLD(50),
     * ZNR(50),ZNI(50),LINECT,MAXLIN,IPAGE,BCG,TCG,FLR,AALT,EPF
C
C     AIRCRAFT-OBSERVER GEOMETRY OUTPUTS
C
      COMMON /GEOMO/ APY(10,17),APZ(10,17),PD(10,17),DPND(10,17),
     * B1(10,17),B2(10,17),TDS(17,10),TPD(17,10),IRR(10,17)
     *,APP,TP,RHP,APO,TC,RHC,CA,CZ,TSP(17,10),CCV
C
      COMMON/GFREQ/CFREQ(24),UFREQ(25),FFREQ(24)
C
      COMMON/HEAD/HIN(20),HOUT(20),CHIN(20)
C
      COMMON/PNLD/PSPL(17,20),EPNL(5,10),TEPNL(5,10)
C
      COMMON/SUMSPL/SSPL(24,10,17)
C
      COMMON/SWITCH/NTYPE,ITYPE,NENG,ICOP,IPRT(7),ICN(13),NLCPT
C
      COMMON/TMSPL/SPZ(24,17),IB(2,3,13)
C
      DATA CO,PSO,RO2,DTOR/1116.4,14.696,10.76,.01745329/
      ICN(13) = ICN(13) + 1
C
C     JETSPEED OF SOUND
      CJ= CO*SQRT(TSR13)
C
C     JET VELOCITY
      VJ=EMJ13*CJ
C
C     AMBIENT VELOCITY
      VO=AMACH*CZ
C
C     REL JET VELOCITY
      FLAPR=FLAP13*DTOR
      ALPHA=FLAPR-ATAN(SLOPE)
      VJR= SQRT(VJ*VJ-2.*VJ*VO*COS(ALPHA)+VO*VO)
C
C     CHARACTERISTIC FREQUENCY
      D=HD13
      IF(IUNIT.EQ.0) D=3.280833*HD13
      FC= VJ /D *1.8/(3.+DDNE13)
C
C     CHARACTERISTIC REFERENCE SOUND LEVEL
C
      AENG=NENG
      COCZ=CO/CZ
      PZPSO=APO*APO/(PSO*PSO)
      TSOTS=1./(TSR13*TSR13)
      ARO= DDA13*D*D/RO2
```

```
      BW=1.
      IF(ISPTRM.EQ.0)BW=1./3.
      SLO=10.*ALOG10(VJ*VJR**4*PZPSC*TSCTS*COCZ*ARG*BW*AENG)
     *-10.* ABS(ALOG10(DJCL13/DDNE13*VJ/VJR))-4.6
      SMT=DHNL13/DDNE13
      IF(AJS13.EQ.0.0)AJS13=5.7
      SMTO=VJR/VJ*TAN(AJS13*DTOR)
      IF(SMT.GT.SMTO)SLO=SLO-24.*ALOG10(SMT/SMTO)
C     DETERMINE DIRECTIVITY ANGLES
      CALL ANGLES(NOBS,FLAPR)
C
C     ITERATE FOR EACH OBSERVER COORDINATE
C     TO DETERMINE SPL DIRECTIVITY CORRECTION(CC)
C
      CFLAP=COS(FLAPR)
      SFLAP=SIN(FLAPR)
C
      DO 300 I=1,NOBS
      CALL LINCOR(SPZ(1,1),0,W,W,W,W,W,W,W,W,W,PSI(1,I),NCF,BCF,
     *W,W,W,W,W,W,W,ICOR13,IB(1,1,ITYPE),0,W)
      X=SLDIST(I)
      X2=X*X
C
      CALL ZERO(SPLT,408)
C
C     LOOP ON THE 17 DIRECTIVITY ANGLES
C
      DO 200 J=1,17
      Y=APY(I,J)
      ZN=APZ(I,J)-ALTR
      ZN2=ZN*ZN
      Y2=Y*Y
      SF=DOPSF(J)
      YPZ=SQRT(Y2+ZN2)
      THETO= ACOS((Y*CFLAP+ZN*SFLAP)/YPZ)
      COSETA=YPZ/SQRT(X2+Y2+ZN2)
      Q= ABS(COSETA)*SIN(.5*THETO)**2/(SF*SF*SF)
      IF(Q.LT.1.0E-10)Q=1.0E-10
      DIRCOR =10.*ALOG10(Q)
C
C     LOOP ON FILTER BAND FREQUENCY FOR EACH DIRECTIVITY ANGLE
C
      DO 100 NF=1,NCF
      DSFN=BCF(NF)*SF/FC
      SSC=10.*ALOG10(DSFN**4.8/(1.+1.5*(DSFN)**5.7)**1.4)
      SPLT(NF,J)=SSC+DIRCOR+SLO-SPZ(NF,J)
      SSPL(NF,I,J)=PWRSUM(SSPL(NF,I,J),SPLT(NF,J))
  100 CONTINUE
  200 CONTINUE
C
C     OUTPUT OF SPECTRA(INDEX,EXTRAPOLATED),AND CALCULATION OF
C     PERCEIVED NOISE LEVELS,AND EFFECTIVE PERCEIVED NOISE LEVELS
C
      IF(IPRT(7).NE.7)GO TO 220
      CALL NOISO(IPRT(7),I,NK,10,CHIN,IUNIT,SLDISX(I),PFREQ,
     *SPLT(1,1),NCF,ITYPE)
  220 CONTINUE
```

```
      DO 240 NF=1,NCF
      DO 240 J=1,17
  240 SPLT(NF,J)= SPLT(NF,J)-ISPL(NF,I,J)
      CALL PNLSUB(SPLT(1,1),PSPL(1,I),IPC(1,I),EPNL(1,I),SPL2,
     *TEPNL(1,I),NK,BCG,TCG,FLR,I,NCBS,IRR(I,1))
      IF(IPRT(3).NE.3)GO TO 300
      CALL NOISO(IPRT(3),I,NK,12,CHIN,ILNIT,SLDISX(I),PFREQ,
     *SPLT(1,1),NCF,ITYPE)
  300 CONTINUE
      RETURN
      END
```

```
      SUBROUTINE JET
C AUTHOR              D. F. MELDRUM
C
C PURPOSE             TO PREDICT JET NOISE FOR THE PHASE B
C                     NASA-AMES FOOTPRINT CONTRACT NAS2-6969.
C
C METHOD              AS DESCRIBED IN REFERENCES 1) AND 2).
C
C INPUTS              VIA LABLED COMMON JETDAT
C
C                     NJET      CODE FOR METHOD OF JET NOISE PREDICTION
C                               0  NO JET NOISE PREDICTION
C                               1  REQUIRES AP, PR, PA, TT, AND VA
C                               2  REQUIRES WP, PR, PA, TT, AND VA
C                               3  REQUIRES AP, WP, VP, AND VA
C                                  OPTIONALY AS, VS, AND WS MAY BE INPUT
C                                  FOR A BYPASS ENGINE.  (REQUIRED FOR
C                                  PROCESSING SECONDARY JET NOISE.)
C                               NOT 0, 1, 2, OR 3 THE DATA WILL BE
C                                  INSPECTED TO DETERMINE THE PROPER
C                                  METHOD.  WILL BE ASSUMED TO BE
C                                  3  IF PR, PA, AND TT ARE ALL ZERO, OR
C                                  2  IF AP IS ZERO, OR
C                                  1  IF WP IS ZERO.
C                     MCODE     CODE FOR USE OF THE STROUHAL CURVES
C                               1  FOR FLIGHT
C                               2  FOR GROUND
C                               3  FOR MIXED
C                     AP        PRIMARY JET NOZZLE AREA            FT*FT
C                     WP        PRIMARY JET WEIGHT FLOW            LBS/SEC
C                     VP        PRIMARY JET VELOCITY (REL)         FT/SEC
C                     AS        SECONDARY JET NOZZLE AREA          FT*FT
C                     WS        SECONDARY JET WEIGHT FLOW          LBS/SEC
C                     VS        SECONDARY JET VELOCITY (REL)       FT/SEC
C                     PR        NOZZLE PRESSURE RATIO (PT/PA)
C                     PA        AMBIENT PRESSURE                   LB/FT/FT
C                     TT        JET TOTAL TEMPERATURE              DEG R
C                     VA        VELOCITY OF THE AIRCRAFT           FT/SEC
C                     DIAMET    EFFECTIVE DIAMETER (OPTIONAL
C                               INPUT FOR ALL METHODS)             FT
C                     ANGJET    ENGINE INCLINATION ANGLE
C
C
C                     VIA LABLED COMMON SWITCH
C
C                     NUMENG    NUMBER OF NOISE SOURCES OF THE SAME
C                               NOISE TYPE.
C
C                     VIA LABLED COMMON GCOMON
C
C                     NOF       1/3 OCTAVE OF FULL OCTAVE SWITCH
C                               OR NUMBER OF FREQUENCY BANDS (8 OR 24)
C                     RETA(24)  DIRECTIVITY ANGLES
C
C                     VIA LABLED COMMON GPRAM
C
C                     AMACH     MACH NUMBER OF THE AIRCRAFT
```

```
C                          NOBS      NUMBER OF OBSERVER POSITIONS
C
C                          VIA LABLED COMMON SUMSPL
C
C                          SSPL      CURRENT TOTAL PREDICTED NOISE FOR NOF
C                                    (8 OR 24) FREQUENCIES, AT NOBS OBSERVER
C                                    POSITIONS FOR 17 DIRECTIVITY ANGLES.
C
C                          VIA LABLED COMMON ANGLE (SET UP BY SUBROUTINE ANGLES
C
C                          PSI       17 DIRECTIVITY ANGLES FOR EACH OF
C                                    NOBS OBSERVER POSITIONS.
C                          PSIC      17 DIRECTIVITY ANGLE PROJECTIONS FOR
C                                    EACH OF NOBS OBSERVER POSITIONS
C                          BETA      ELEVATION ANGLE PROJECTION FOR EACH
C                                    OF NOBS OBSERVER POSITIONS.
C
C                          EACH COMPONENT IS WRITTEN ON TAPE OR FILE 10
C                          FOR EACH OF NOF BANDS FOR EACH OF NOBS OBSERVER
C                          POSITIONS.
C
C OUTPUTS                  VIA LABLED COMMON SUMSPL
C
C                          SSPL      CURRENT TOTAL PREDICTED NOISE FOR
C                                    8 OR 24 FREQUENCIES, AT NOBS OBSERVER
C                                    POSITIONS FOR 17 DIRECTIVITY ANGLES.
C
C                          VIA LABLED COMMON ANGLE (SET UP BY SUBROUTINE ANGLES
C
C                          PSI       17 DIRECTIVITY ANGLES FOR EACH OF
C                                    NOBS OBSERVER POSITIONS.
C                          PSIC      17 DIRECTIVITY ANGLE PROJECTIONS FOR
C                                    EACH OF NOBS OBSERVER POSITIONS
C                          BETA      ELEVATION ANGLE PROJECTION FOR EACH
C                                    OF NOBS OBSERVER POSITIONS.
C
C
C REFERENCES               1)  R. J. SAXBY,  JET NOISE PREDICTION PROCEDURE
C                              FOR THE NASA-AMES FOOTPRINT CONTRACT NAS2-6969,
C                              UN-NUMBERED COORDINATION SHEET,  DATED
C                              17 JANUARY 1973.
C
C FUNCTION SUBPRGM         COS       ESHLDG     PWRSUM
C
C SUBROUTINES              ANGLES    UNIT       JETNOS        ZERO
C
C
C
      COMMON /JETDAT/ NJET,MCODE,AF,WF,VF,AS,WS,VS,
     *                PR,PA,TT,VA,DIAMET,ANGJET,ICORI
C
      COMMON/SWITCH/NTYPE,ITYPE,NENG,IDCF,IPRT(7),ICN(13),NLCPT
     *,INSEOW(3),INSHLD
      COMMON/SHLDJT/SPLP(24,17),SPLS(24,17)
C
C     CONSTANTS USED IN INTERNAL CALCULATIONS
C
```

```
      COMMON /GCONST/ IN,IO,IT1,IT2,F0,F1,F2,F3,F4,F5,F6,F7,F8,F9,F10,
     *                IO,I1,I2,I3,I4,I5,I6,I7,I8,I9,I10,P1,P33,P5,P001,
     *                EPS,UNDEF,BL,ICD,DPR,RPD,ETA(17),M1,FM1,I17,A,PI
C
C     VARIABLE SET CALCULATED IN THE PROGRAM PROCESSING
C
      COMMON /GCOMON/ NCF,NK,BCF(24),TSPL(24,10,17),SPLT(24,17),
     *BUF(25),RETA(17),SPL2(17),TGAGR(24),DCPSF(17)
      COMMON/SUMSPL/SSPL(24,10,17)
      COMMON/PNLD/PSPL(17,20),EPNL(5,10),TEPNL(5,10)
C
C     FREQUENCY BANDS USED BY PROGRAM
C
      COMMON /GFREQ/ CFREQ(24),UFREQ(25),PFREQ(24)
C
C     GENERAL INPUT PARAMETERS
      COMMON/ANGLE/PSI(17,10),PSIO(17,10),BETA(17,10)
C
      COMMON /GPRAM/ALTP,ALTR,SLOPE,AMACH,NCBS,SLDIST(10),ITENG,IUNIT
     *     ,ISPTRM,IATMOS,IAIR,UAIRAB(24),NTEMP,TEMP(50),TALT(50)
     *     ,NPRES,PRES(50),PALT(50),NHUMIC,RALT(50),RHUMID(50),CTEMP
     *     ,CPRES,CRHUMD,IEGA,IGDR,DTEMP,CPRES,CHUMID,XKN,ND,FLD(50),
     * ZNR(50),ZNI(50),LINECT,MAXLIN,IPAGE,BCJ,TOG,FLR,AALT,EPF
C
C     AIRCRAFT-OBSERVER GEOMETRY OUTPUTS
C
      COMMON /GEOML/ APY(10,17),APZ(10,17),PD(10,17),DPND(10,17),
     * B1(10,17),B2(10,17),TDS(17,10),TPD(17,10),IRR(10,17)
     *,APP,TP,RHP,APO,TG,RHC,CA,CZ,TSP(17,10),CCV
C
C     CONVERSION CONSTANTS
C
      COMMON/GCONVC/C(2,10),SLDISX(10)
      COMMON/HEAD/HIN(20),HCUT(20),CHIN(20)
      COMMON/TMSPL/SPZ(24,17),IB(2,3,13)
      COMMON/CRSPLS/DOB(17),PSCR(17),CPB(408),NPSCR
C
      DIMENSION DSPL(24,17)
C
      PA=APO*144.
C
C
      IF(ITYPE.EQ.1) ICN(1)=ICN(1)+1
      IF(ITYPE.EQ.2) ICN(2)=ICN(2)+1
      VA=AMACH*CZ
C
C
      DELTA=ANGJET*RPD
      CALL ANGLES(NOBS,DELTA)
C
C
C     LOOP FOR THE NUMBER OF OBSERVER POSITIONS
C
   40 DO 1000 M=1,NOBS
      CALL LINCOR(SPZ(1,1),0,X,X,X,X,X,X,X,X,X,PSI(1,M),NCF,
     *BCF,X,X,X,X,X,X,X,ICOR1,IB(1,1,ITYPE),0,X)
C
```

```
      CALL ZERO(SPLT,408)
      CALL ZERO(SPLP,408)
      CALL ZERO(SPLS,408)
      CALL ZERO(DSPL,408)
C
C
C
C     CALCULATE THE JET NOISE PREDICTION
C
      CALL JETNOS(PSI(1,M),SPLT(1,1))
C
C
   45 CONTINUE
C
C     CONVERT TO A UNIT OR INDEXED SPECTRA
C
      CALL UNIT(150.,17,SPLT(1,1))
      CALL UNIT(150.,17,SPLP(1,1))
      CALL UNIT(150.,17,SPLS(1,1))
      ENG=NENG
      IF(ENG.LE.0.0) ENG=1.0
      DO 50 J=1,17
      ELVANG=BETA(J,M)
      DANGLE=PSIO(J,M)
      ENS=ESHLDG(DANGLE,ELVANG,ENG)
      DO 50 K=1,24
      SPLP(K,J)=SPLP(K,J)-ENS
      SPLS(K,J)=SPLS(K,J)-ENS
   50 SPLT(K,J)=SPLT(K,J)-ENS
      IF( NOF.EQ.24 ) GO TO 250
C
C     CONVERT 1/3 OCTAVE TO FULL OCTAVE
C
      DO 200 J=1,17
      DO 200 K=1,8
      TMP  =  0.
      DO 100 L=1,3
      JC  =  3 * K + L - 3
  100 TMP  =  PWRSUM(TMP, SPLT(JC,J))
  200 SPLT(K,J)  =  TMP
C
      DO  22 J=1,17
      DO 22 K=1,8
      TMP  =  0.
      DO 11 L=1,3
      JC  =  3 * K + L - 3
   11 TMP  =  PWRSUM(TMP, SPLP(JC,J))
   22 SPLP(K,J)  =  TMP
      IF(ITYPE.NE.2)GO TO 55
      DO 44 J=1,17
      DO 44 K=1,8
      TMP  =  0.
      DO 33 L=1,3
      JC  =  3 * K + L - 3
   33 TMP  =  PWRSUM(TMP, SPLS(JC,J))
   44 SPLS(K,J)  =  TMP
   55 CONTINUE
```

```
C
  250 IF( INSHLD.EQ.0 ) GO TO 300
      CALL JNSA(APY,APZ,ALTR,BCF,CZ,DELTA,DIAMET,VP,VS,
     *          SLDIST,M,NCF,SPLP,SPLS,SPLT,ITYPE,CSPL,IUNIT)
C
C
C     ADD TO CURRENT TOTAL AND WRITE ON TAPE 10
C
C
  300 DO 400 J=1,NCF
      DO 350 K=1,17
      SPLP(J,K)=SPLP(J,K)-SPZ(J,K)
      SPLS(J,K)=SPLS(J,K)-SPZ(J,K)
      SPZ(J,K)=SPZ(J,K)+DSPL(J,K)
      SPLT(J,K)=SPLT(J,K)-SPZ(J,K)
  350 SSPL(J,M,K)=PWRSUM(SSPL(J,M,K),SPLT(J,K))
  400 CONTINUE
      IF(IPRT(7).NE.7)GO TO 410
      CALL NOISO(IPRT(7),M,NK,10,CHIN,IUNIT,SLDISX(M),PFREQ,SPLT(1,1),
     *  NCF,ITYPE)
  410 CONTINUE
      DO 360 JC=1,NCF
      DO 360 KC=1,17
  360 SPLT(JC,KC)=SPLT(JC,KC)-TSPL(JC,M,KC)
      CALL PNLSUB(SPLT(1,1),PSPL(1,M),TPC(1,M),EPNL(1,M),SPL2,
     *TEPNL(1,M),NK,BCG,TCG,FLR,M,NCBS,IRR(M,1))
      IF(IPRT(3).NE.3)GO TO 1000
      CALL NOISO(IPRT(3),M,NK,12,CHIN,IUNIT,SLDISX(M),PFREQ,
     *    SPLT(1,1),NCF,ITYPE)
C
C
C
 1000 CONTINUE
      RETURN
      END
```

```
      SUBROUTINE JETNOS(ANGLES,SPL)                                     JETNOS
C AUTHOR             D. F. MELDRUM                                      JETNOS
C                                                                       JETNOS
C PURPOSE            TO PREDICT JET NOISE FOR THE PHASE 8 NASA-AMES     JETNOS
C                    FOOTPRINT CONTRACT NAS2-6969.  NOISE IS PREDICTED  JETNOS
C                    AT 150 FEET AS A SINGLE SOURCE WITHOUT             JETNOS
C                    SHIELDING EFFECTS.                                 JETNOS
C                                                                       JETNOS
C METHOD             AS DESCRIBED IN REFERENCE 1).                      JETNOS
C                                                                       JETNOS
C INPUTS             VIA THE CALL                                       JETNOS
C                                                                       JETNOS
C                    ANGLES    DIRECTIVITY ANGLES                       JETNOS
C                                                                       JETNOS
C                    VIA LABLED COMMON JETDAT                           JETNOS
C                                                                       JETNOS
C                    NJET      CODE FOR METHOD OF JET NOISE PREDICTION  JETNOS
C                              0  NO JET NOISE PREDICTION               JETNOS
C                              1  REQUIRES AP, PR, PA, TT, AND VA       JETNOS
C                              2  REQUIRES WP, PR, PA, TT, AND VA       JETNOS
C                              3  REQUIRES AP, WP, VP, AND VA           JETNOS
C                                 OPTIONALY AS, VS, AND WS MAY BE INPUT JETNOS
C                                 FOR A BYPASS ENGINE.  (REQUIRED FOR   JETNOS
C                                 PROCESSING SECONDARY JET NOISE.)      JETNOS
C                                 INSPECTED TO DETERMINE THE PROPER     JETNOS
C                                 METHOD.  WILL BE ASSUMED TO BE        JETNOS
C                                 3  IF PR, PA, AND TT ARE ALL ZERO, OR JETNOS
C                                 2  IF AP IS ZERO, OR                  JETNOS
C                                 1  IF WP IS ZERO.                     JETNOS
C                    MCODE     CODE FOR USE OF THE STROUHAL CURVES      JETNOS
C                              1  FOR FLIGHT                            JETNOS
C                              2  FOR GROUND                            JETNOS
C                              3  FOR MIXED                             JETNOS
C                    AP        PRIMARY JET NOZZLE AREA        FT*FT     JETNOS
C                    WP        PRIMARY JET WEIGHT FLOW        LBS/SEC   JETNOS
C                    VP        PRIMARY JET VELOCITY (REL)     FT/SEC    JETNOS
C                    AS        SECONDARY JET NOZZLE AREA      FT*FT     JETNOS
C                    WS        SECONDARY JET WEIGHT FLOW      LBS/SEC   JETNOS
C                    VS        SECONDARY JET VELOCITY (REL)   FT/SEC    JETNOS
C                    PR        NOZZLE PRESSURE RATIO (PT/PA)            JETNOS
C                    PA        AMBIENT PRESSURE               LB/FT/FT  JETNOS
C                    TT        JET TOTAL TEMPERATURE          DEG R     JETNOS
C                    VA        VELOCITY OF THE AIRCRAFT       FT/SEC    JETNOS
C                    DIAMET    EFFECTIVE DIAMETER (OPTIONAL             JETNOS
C                              INPUT FOR ALL METHODS)         FT        JETNOS
C                    ANGJET    ENGINE INCLINATION ANGLE                 JETNOS
C                                                                       JETNOS
C OUTPUTS            SPL       SPECTRA PREDICTED FOR JET NOISE          JETNOS
C                                                                       JETNOS
C REFERENCES         1)  R. J. SAXBY,  JET NOISE PREDICTION PROCEDURE   JETNOS
C                        FOR THE NASA-AMES FOOTPRINT CONTRACT NAS2-6969, JETNOS
C                        UN-NUMBERED COORDINATION SHEET,  DATED         JETNOS
C                        17 JANUARY 1973.                               JETNOS
C                                                                       JETNOS
C FUNCTION SUBPRGM   ATAN      SQRT      COS                            JETNOS
C                                                                       JETNOS
      COMMON /JETDAT/ NJET,MCODE,AP,WP,VP,AS,WS,VS,                     JETNOS
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```
     *             PR,PA,TT,VA,DIAMET,ANGJET
C
C     ARRAYS FOR PRIMARY AND SECONDARY SPL USED IN JET NOISE SHIELDING
      COMMON/SHLDJT/SPLP(24,17),SPLS(24,17)
C
      COMMON /GPRAM/  DUM6(2),GRAD
      DIMENSION TID(8,19,24),ANGLES(17),SPL(24,17)
      DIMENSION D01(8,19),D02(8,19),D03(8,19),D04(8,19),D05(8,19),
     *          D06(8,19),D07(8,19),D08(8,19),D09(8,19),D10(8,19),
     *          D11(8,19),D12(8,19),D13(8,19),D14(8,19),D15(8,19),
     *          D16(8,19),D17(8,19),D18(8,19),D19(8,19),D20(8,19),
     *          D21(8,19),D22(8,19),D23(8,19),D24(8,19)
      EQUIVALENCE(TID(1,1, 1),D01(1,1)),(TID(1,1, 2),D02(1,1)),
     *           (TID(1,1, 3),D03(1,1)),(TID(1,1, 4),D04(1,1)),
     *           (TID(1,1, 5),D05(1,1)),(TID(1,1, 6),D06(1,1)),
     *           (TID(1,1, 7),D07(1,1)),(TID(1,1, 8),D08(1,1)),
     *           (TID(1,1, 9),D09(1,1)),(TID(1,1,10),D10(1,1)),
     *           (TID(1,1,11),D11(1,1)),(TID(1,1,12),D12(1,1)),
     *           (TID(1,1,13),D13(1,1)),(TID(1,1,14),D14(1,1)),
     *           (TID(1,1,15),D15(1,1)),(TID(1,1,16),D16(1,1)),
     *           (TID(1,1,17),D17(1,1)),(TID(1,1,18),D18(1,1)),
     *           (TID(1,1,19),D19(1,1)),(TID(1,1,20),D20(1,1)),
     *           (TID(1,1,21),D21(1,1)),(TID(1,1,22),D22(1,1)),
     *           (TID(1,1,23),D23(1,1)),(TID(1,1,24),D24(1,1))
      DATA D01/-13.90, -5.10,-14.10,-16.50,-16.33,-16.20,-18.67,-19.33,
     *         -13.40, -6.33,-13.93,-16.20,-16.33,-16.83,-18.67,-19.33,
     *         -13.00, -7.47,-13.60,-15.93,-16.20,-17.37,-18.67,-19.37,
     *         -12.40, -7.83,-13.33,-15.60,-16.07,-17.50,-18.67,-19.50,
     *         -11.50, -8.00,-13.13,-15.20,-15.87,-17.37,-18.67,-19.67,
     *         -10.60, -7.83,-12.60,-14.77,-15.47,-16.77,-18.43,-19.63,
     *          -9.40, -7.40,-12.13,-14.27,-14.73,-16.10,-17.67,-18.93,
     *          -8.20, -6.47,-11.50,-13.50,-14.03,-15.10,-16.77,-17.93,
     *          -6.80, -5.13,-10.50,-12.57,-13.00,-14.03,-15.37,-16.33,
     *          -5.10, -3.77, -8.97,-11.33,-11.63,-12.70,-13.77,-14.47,
     *          -3.30, -2.33, -7.40, -9.70, -9.97,-11.00,-12.13,-12.47,
     *          -2.00,  -.83, -5.77, -7.87, -7.77, -7.90, -9.47, -9.80,
     *          -1.20,   .83, -3.27, -4.33, -3.00, -3.80, -4.33, -2.67,
     *            .50,  2.43,   .20,  -.23,  2.00,  1.13,  1.13,  3.23,
     *           2.30,  4.10,  4.83,  5.07,  6.00,  5.67,  5.67,  6.00,
     *           5.50,  5.87,  7.13,  7.33,  7.63,  8.00,  8.17,  6.67,
     *           7.00,  5.67,  6.73,  7.20,  8.00,  6.50,  7.00,  5.00,
     *           7.50,  5.50,  6.30,  7.10,  8.40,  5.20,  5.80,  3.20,
     *         -12.50,-14.50,-13.70,-13.00,-11.60,-14.90,-14.30,-16.70/
      DATA D02/-11.40, -6.20,-14.00,-16.50,-17.20,-17.20,-19.00,-19.00,
     *         -11.00, -6.90,-13.80,-16.30,-17.00,-17.50,-19.00,-19.00,
     *         -10.60, -7.60,-13.60,-16.10,-16.90,-17.90,-19.00,-19.00,
     *         -10.00, -8.10,-13.40,-15.80,-16.70,-18.00,-19.00,-19.00,
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     *          -8.20, -8.20,-12.70,-14.90,-15.90,-17.20,-18.80,-18.80,
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     *          -4.40, -5.60,-10.50,-12.50,-13.20,-14.40,-15.80,-15.80,
     *          -2.70, -4.20, -9.00,-11.20,-11.80,-12.90,-14.10,-14.10,
     *          -2.40, -2.70, -7.40, -9.50,-10.00,-11.00,-12.10,-12.10,
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     *       -9.60, -8.63,-13.53,-16.20,-17.97,-19.00,-19.67,-18.00,  JETNOS
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     *        -11.60, -8.33,-12.07,-15.20,-18.00,-18.50,-19.17,-17.50,  JETNOS   179
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     *     -3.80, -5.40, -7.80,-10.00,-13.90,-11.60,-10.00,-10.70,   JETNOS    277
     *     -3.60, -5.10, -7.20, -9.30,-13.00,-11.20,-13.00,-10.40,   JETNOS    278
     *     -3.20, -4.50, -6.40, -8.40,-11.90,-10.80,-10.00,-10.00,   JETNOS    279
     *     -2.70, -3.80, -5.40, -7.40,-10.50,-10.20,-10.00, -9.50,   JETNOS    280
     *     -2.00, -3.00, -4.10, -6.10, -8.80, -9.40, -9.80, -8.90,   JETNOS    281
     *     -1.20, -2.00, -2.70, -4.50, -6.80, -8.20, -9.00, -7.80,   JETNOS    282
     *      -.10,  -.70,  -.90, -2.50, -4.40, -6.50, -8.00, -5.00,   JETNOS    283
     *      1.30,  1.20,  1.20,   .30, -1.80, -3.50, -5.50,   .50,   JETNOS    284
     *      2.90,  3.40,  3.80,  2.80,  1.20,  0.00, -1.00,  5.50,   JETNOS    285
     *      2.80,  4.00,  4.80,  4.50,  4.00,  4.50,  7.00,  3.00,   JETNOS    286
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     *         2.00,   3.00,   3.80,   4.80,   5.90,   6.50,   7.00,   3.00,   JETNOS
     *         1.00,   1.50,   1.70,   3.50,   5.70,   6.00,   6.00,  -2.00,   JETNOS
     *        -1.00,   -.50,   -.90,    .20,   2.00,   1.50,   1.00,  -5.00,   JETNOS
     *        -3.10,  -2.30,  -3.30,  -3.10,  -1.70,  -3.30,  -3.80,  -8.00,   JETNOS
     *       -23.10,-22.30,-23.40,-23.10,-21.80,-23.30,-23.80,-28.00/   JETNOS
      DATA D12/ -3.00,  -4.10,  -8.10,-10.80,-14.80,-12.90,-10.60,-12.40,   JETNOS
     *        -2.93,  -4.40,  -8.13,-10.53,-14.33,-12.20,-10.33,-11.80,   JETNOS
     *        -2.93,  -4.73,  -8.13,-10.33,-13.80,-11.63,-10.03,-11.30,   JETNOS
     *        -2.87,  -4.87,  -7.87,-10.00,-13.20,-11.07,  -9.73,-10.80,   JETNOS
     *        -2.87,  -4.77,  -7.43,  -9.40,-12.37,-10.47,  -9.40,-10.30,   JETNOS
     *        -2.73,  -4.47,  -6.80,  -8.60,-11.27,  -9.90,  -9.10,  -9.80,   JETNOS
     *        -2.43,  -3.94,  -6.00,  -7.60,-10.10,  -9.30,  -8.77,  -9.23,   JETNOS
     *        -2.10,  -3.30,  -5.00,  -6.47,  -8.63,  -8.53,  -8.47,  -8.63,   JETNOS
     *        -1.60,  -2.60,  -3.67,  -4.73,  -6.97,  -7.57,  -8.00,  -7.90,   JETNOS
     *        -1.07,  -1.70,  -2.20,  -3.43,  -5.03,  -6.30,  -7.07,  -6.73,   JETNOS
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     *         1.20,   1.43,   1.67,    .97,   -.50,  -2.00,  -3.63,   1.67,   JETNOS
     *         2.60,   3.27,   3.80,   3.07,   1.97,   1.03,    .33,   5.67,   JETNOS
     *         1.20,   2.70,   4.17,   3.07,   4.00,   4.50,   5.00,   5.43,   JETNOS
     *         0.00,   1.50,   2.20,   4.07,   5.23,   5.83,   6.33,   2.23,   JETNOS
     *         -.47,    .33,   -.40,   2.50,   4.83,   5.00,   5.00,  -2.33,   JETNOS
     *        -1.33,  -1.00,   -.97,   0.00,   2.00,   1.67,   -.67,  -5.33,   JETNOS
     *        -2.20,  -2.40,  -1.70,  -2.60,   -.90,  -1.50,  -6.60,  -8.10,   JETNOS
     *       -22.20,-22.30,-21.70,-22.60,-20.90,-21.50,-26.60,-28.10/   JETNOS
      DATA D13/ -2.00,  -4.40,  -8.20,-11.00,-14.60,-12.40,-11.50,-12.70,   JETNOS
     *        -1.97,  -4.30,  -7.97,-10.57,-13.67,-11.60,-10.67,-12.00,   JETNOS
     *        -1.97,  -4.37,  -7.87,-10.16,-12.80,-10.86,-10.07,-11.30,   JETNOS
     *        -1.93,  -4.33,  -7.53,  -9.60,-11.90,-10.13,  -9.47,-10.60,   JETNOS
     *        -1.93,  -4.13,  -7.07,  -8.80,-10.83,  -9.33,  -8.80,  -9.90,   JETNOS
     *        -1.87,  -3.83,  -6.40,  -7.90,  -9.53,  -8.60,  -8.20,  -9.20,   JETNOS
     *        -1.66,  -3.37,  -5.60,  -6.80,  -8.30,  -7.80,  -7.53,  -8.47,   JETNOS
     *        -1.50,  -2.80,  -4.60,  -5.53,  -6.77,  -6.86,  -6.93,  -7.77,   JETNOS
     *        -1.20,  -2.20,  -3.23,  -3.37,  -5.13,  -5.73,  -6.20,  -6.90,   JETNOS
     *         -.93,  -1.40,  -1.70,  -2.37,  -3.27,  -4.40,  -5.13,  -5.77,   JETNOS
     *         -.30,   -.23,    .10,   -.43,  -1.20,  -2.76,  -3.86,  -2.87,   JETNOS
     *         1.10,   1.67,   2.13,   1.63,    .80,   -.50,  -1.77,   2.83,   JETNOS
     *         2.30,   3.13,   3.80,   3.33,   2.73,   2.07,   1.67,   5.83,   JETNOS
     *         -.40,   1.40,   3.53,   4.17,   4.00,   4.50,   5.00,   4.87,   JETNOS
     *        -2.00,   0.00,    .67,   3.33,   4.57,   5.17,   5.67,   1.47,   JETNOS
     *        -1.93,   -.83,   -.17,   1.50,   3.97,   4.00,   4.00,  -2.67,   JETNOS
     *        -1.67,  -1.50,  -1.03,   -.20,   2.00,   1.83,  -2.33,  -5.67,   JETNOS
     *        -2.00,  -2.20,  -1.80,  -1.80,   0.00,   -.40,  -8.80,  -8.50,   JETNOS
     *       -22.00,-22.20,-21.80,-21.80,-20.00,-20.40,-28.80,-28.50/   JETNOS
      DATA D14/ -1.00,  -4.40,  -8.00,-11.40,-14.20,-12.00,-12.00,-13.30,   JETNOS
     *        -1.00,  -4.20,  -7.80,-10.60,-13.00,-11.00,-11.00,-12.20,   JETNOS
     *        -1.00,  -4.00,  -7.60,-10.00,-11.80,-10.10,-10.10,-11.30,   JETNOS
     *        -1.00,  -3.80,  -7.20,  -9.20,-10.60,  -9.20,  -9.20,-10.40,   JETNOS
     *        -1.00,  -3.50,  -6.70,  -8.20,  -9.30,  -8.20,  -8.20,  -9.50,   JETNOS
     *        -1.00,  -3.20,  -6.00,  -7.20,  -7.80,  -7.30,  -7.30,  -8.60,   JETNOS
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     *         -.80,  -1.10,  -1.20,  -1.30,  -1.50,  -2.50,  -3.20,  -4.60,   JETNOS
     *         -.40,   0.00,    .60,    .60,    .40,   -.90,  -1.80,  -1.80,   JETNOS
     *         1.00,   1.90,   2.60,   2.30,   2.10,   1.00,    .10,   4.00,   JETNOS
     *         2.00,   3.00,   3.80,   3.60,   3.50,   3.10,   3.00,   6.00,   JETNOS
     *        -2.00,    .10,   2.90,   4.00,   4.00,   4.50,   5.00,   4.30,   JETNOS
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*           -4.00, -2.00, -1.10,  -.40,  2.00,  2.00, -4.00, -6.00,  JETNUS
*           -4.00, -2.00, -1.20, -1.40,   .80,   .90,-11.20, -8.90,  JETNUS
*          -24.00,-22.00,-21.20,-21.50,-19.20,-19.10,-31.20,-28.90/  JETNUS
  DATA D15/ -3.00, -5.30, -7.80,-10.30,-12.80,-11.40,-11.90,-12.50,  JETNUS
*           -3.00, -5.13, -7.53, -9.67,-11.67,-10.50,-11.03,-11.53,  JETNUS
*           -2.97, -4.97, -7.37, -9.20,-10.70, -9.73,-10.30,-10.67,  JETNUS
*           -2.73, -4.60, -6.87, -8.40, -9.63, -8.90, -9.47, -9.80,  JETNUS
*           -2.50, -4.17, -6.30, -7.47, -8.50, -8.00, -8.57, -8.87,  JETNUS
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*           -1.97, -3.23, -4.83, -5.47, -6.10, -6.20, -6.57, -6.97,  JETNUS
*           -1.73, -2.63, -3.87, -4.20, -4.70, -5.17, -5.57, -6.00,  JETNUS
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*           -3.33, -2.00, -1.40,   .07,  2.40,  2.60,  2.77, -3.46,  JETNUS
*           -3.30, -1.67, -1.57, -1.37,  0.00,  -.17, -4.17, -6.33,  JETNUS
*           -3.30, -2.00, -1.80, -3.10, -2.40, -2.70,-10.80, -9.10,  JETNUS
*          -23.30,-22.00,-21.80,-23.10,-22.40,-22.80,-30.90,-29.10/  JETNUS
  DATA D16/ -5.00, -6.40, -7.60, -9.10,-11.10,-10.60,-11.70,-12.00,  JETNUS
*           -5.00, -6.07, -7.27, -8.73,-10.33,-10.00,-11.07,-10.87,  JETNUS
*           -4.93, -5.93, -7.13, -8.40, -9.60, -9.37,-10.50,-10.03,  JETNUS
*           -4.47, -5.40, -6.53, -7.60, -8.67, -8.60, -9.73, -9.20,  JETNUS
*           -4.00, -4.83, -5.90, -6.73, -7.70, -7.80, -8.93, -8.23,  JETNUS
*           -3.53, -4.27, -5.20, -5.87, -6.66, -7.04, -7.97, -7.27,  JETNUS
*           -3.03, -3.67, -4.47, -4.93, -5.70, -6.10, -6.83, -6.23,  JETNUS
*           -2.57, -2.97, -3.53, -3.80, -4.50, -5.13, -5.73, -5.10,  JETNUS
*           -2.13, -2.27, -1.66, -2.33, -3.30, -3.90, -4.53, -3.77,  JETNUS
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*            -.67,  -.30,  1.36,  2.87,  4.00,  4.43,  5.00,  4.10,  JETNUS
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*           -2.67, -2.00, -1.70,  -.37,  1.70,  2.20,  2.53, -3.93,  JETNUS
*           -2.67, -1.33, -2.03, -2.33, -2.00, -2.33, -4.33, -6.67,  JETNUS
*           -2.70, -2.00, -2.40, -4.10, -5.60, -6.50,-11.30, -9.30,  JETNUS
*          -22.70,-22.00,-22.30,-24.10,-25.70,-26.40,-31.30,-29.30/  JETNUS
  DATA D17/ -7.10, -7.10, -7.10, -8.10, -9.60,-10.20,-11.70,-11.20,  JETNUS
*           -7.00, -7.00, -7.00, -7.80, -9.00, -9.50,-11.10,-10.20,  JETNUS
*           -6.90, -6.90, -6.90, -7.60, -8.50, -9.00,-10.70, -9.40,  JETNUS
*           -6.20, -6.20, -6.20, -6.80, -7.70, -8.30,-10.00, -8.60,  JETNUS
*           -5.50, -5.50, -5.50, -6.00, -6.90, -7.60, -9.30, -7.60,  JETNUS
*           -5.50, -5.50, -4.80, -5.20, -6.10, -6.90, -8.30, -6.60,  JETNUS
*           -4.10, -4.10, -4.10, -4.40, -5.30, -6.00, -7.10, -5.50,  JETNUS
*           -3.40, -3.30, -3.20, -3.40, -5.30, -5.10, -5.90, -4.20,  JETNUS
*           -2.80, -2.50, -2.20, -2.50, -3.30, -3.90, -4.60, -2.70,  JETNUS
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*             .90,  1.40,  2.70,  2.60,  2.00,  1.70,  1.20,  4.00,  JETNUS
*            3.00,  3.00,  3.00,  3.20,  3.50,  3.50,  3.50,  5.00,  JETNUS
*            0.00,  -.50,   .60,  2.30,  4.00,  4.40,  5.00,  4.00,  JETNUS
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     *          -2.00, -2.00, -2.00,  -.80,  1.00,  1.80,  2.30, -4.40,   JETNOS   402
     *          -2.00, -1.00, -2.50, -3.30, -4.00, -4.50, -4.50, -7.00,   JETNOS   403
     *          -2.00, -2.00, -3.00, -5.60, -9.10,-10.70,-11.50, -9.60,   JETNOS   404
     *        -22.00,-22.00,-23.00,-25.60,-29.20,-30.70,-31.50,-29.50/   JETNOS   405
      DATA C18/ -6.30, -6.20, -6.80, -7.90, -9.70, -9.50,-10.00,-10.70,   JETNOS   406
     *          -5.93, -6.33, -6.60, -7.60, -9.00, -8.93, -9.73, -9.80,   JETNOS   407
     *          -5.67, -6.37, -6.50, -7.33, -8.43, -8.50, -9.47, -9.10,   JETNOS   408
     *          -5.00, -5.37, -5.93, -6.60, -7.67, -7.86, -9.00, -8.34,   JETNOS   409
     *          -4.37, -4.70, -5.27, -5.87, -6.87, -7.23, -8.40, -7.40,   JETNOS   410
     *          -3.73, -4.03, -4.57, -5.07, -6.03, -6.60, -7.60, -6.40,   JETNOS   411
     *          -3.17, -3.40, -3.83, -5.67, -5.20, -5.67, -6.60, -5.33,   JETNOS   412
     *          -2.67, -2.73, -2.93, -3.17, -4.17, -4.73, -5.60, -4.13,   JETNOS   413
     *          -2.20, -2.00, -1.80, -2.13, -3.07, -3.60, -4.40, -2.80,   JETNOS   414
     *          -1.97, -1.23,  -.40,  -.60, -1.67, -1.93, -2.67, -1.00,   JETNOS   415
     *          -1.63,  -.07,  1.70,  1.40,  -.07,  -.07,  -.67,  1.00,   JETNOS   416
     *           1.60,  2.03,  3.07,  3.00,  2.33,  1.97,  1.63,  3.50,   JETNOS   417
     *           4.00,  3.33,  2.93,  3.07,  3.33,  3.50,  3.67,  4.67,   JETNOS   418
     *           1.00,   .30,   .60,  1.90,  3.33,  4.10,  5.00,  3.50,   JETNOS   419
     *           -.83, -1.13, -1.33,   .33,  2.03,  3.33,  4.67,  -.93,   JETNOS   420
     *          -1.27, -1.67, -2.43, -1.67,  -.20,  1.03,  2.03, -4.60,   JETNOS   421
     *          -1.27,  -.83, -2.73, -3.80, -4.67, -5.67, -6.33, -7.33,   JETNOS   422
     *          -1.27, -1.70, -3.00, -5.70, -9.40,-11.80,-14.50,-10.00,   JETNOS   423
     *         -21.27,-21.70,-23.00,-25.70,-29.30,-31.90,-34.50,-30.00/   JETNOS   424
      DATA C19/ -5.50, -5.70, -6.20, -7.80, -9.50, -8.80, -8.60,-10.10,   JETNOS   425
     *          -4.87, -5.67, -6.20, -7.40, -9.00, -8.37, -8.37, -9.40,   JETNOS   426
     *          -4.43, -5.83, -6.10, -7.07, -8.37, -8.00, -8.23, -8.80,   JETNOS   427
     *          -3.80, -4.53, -5.67, -6.40, -7.63, -7.43, -8.00, -8.07,   JETNOS   428
     *          -3.23, -3.90, -5.03, -5.73, -6.83, -6.87, -7.50, -7.20,   JETNOS   429
     *          -2.67, -3.27, -4.33, -4.93, -5.97, -6.30, -6.90, -6.20,   JETNOS   430
     *          -2.23, -2.70, -3.57, -4.00, -5.10, -5.33, -6.10, -5.17,   JETNOS   431
     *          -1.94, -2.17, -2.67, -2.93, -4.03, -4.37, -5.30, -4.07,   JETNOS   432
     *          -1.60, -1.50, -1.40, -1.77, -2.83, -3.30, -4.20, -2.90,   JETNOS   433
     *          -1.33,  -.87,   .20,  -.20, -1.33, -1.47, -2.33, -1.00,   JETNOS   434
     *           -.77,   .37,  2.10,  1.80,   .37,   .47,  -.33,  1.00,   JETNOS   435
     *           2.30,  2.67,  3.43,  3.40,  2.67,  2.23,  2.07,  3.00,   JETNOS   436
     *           5.00,  3.67,  2.87,  2.93,  3.17,  3.50,  3.83,  4.33,   JETNOS   437
     *           2.00,  1.10,   .60,  1.50,  2.67,  3.80,  5.00,  3.00,   JETNOS   438
     *           -.17,  -.77, -1.57,  -.43,  1.07,  2.67,  4.33,  -.97,   JETNOS   439
     *           -.53, -1.33, -2.87, -2.53, -1.40,   .27,  1.77, -4.80,   JETNOS   440
     *           -.53,  -.67, -2.97, -4.30, -5.33, -6.83, -8.17, -7.67,   JETNOS   441
     *           -.70, -1.30, -2.90, -6.00, -9.10,-13.50,-17.80,-10.20,   JETNOS   442
     *         -20.70,-21.30,-22.80,-26.00,-29.20,-33.60,-37.80,-30.20/   JETNOS   443
      DATA C20/ -4.40, -5.80, -6.00, -7.80, -9.80, -8.20, -7.00, -9.60,   JETNOS   444
     *          -3.80, -5.00, -5.80, -7.20, -9.00, -7.80, -7.00, -9.00,   JETNOS   445
     *          -3.20, -4.30, -5.70, -6.80, -8.30, -7.50, -7.00, -8.50,   JETNOS   446
     *          -2.60, -3.70, -5.40, -6.20, -7.60, -7.00, -7.00, -7.80,   JETNOS   447
     *          -2.10, -3.10, -4.80, -5.60, -6.80, -6.50, -6.60, -7.00,   JETNOS   448
     *          -1.60, -2.50, -4.10, -4.80, -5.90, -6.00, -6.20, -6.00,   JETNOS   449
     *          -1.30, -2.00, -3.30, -3.80, -5.00, -5.00, -5.60, -5.00,   JETNOS   450
     *          -1.20, -1.60, -2.40, -2.70, -3.90, -4.00, -5.00, -4.00,   JETNOS   451
     *          -1.00, -1.00, -1.00, -1.40, -2.60, -3.00, -4.00, -3.00,   JETNOS   452
     *           -.70,  -.50,   .80,   .20, -1.00, -1.00, -2.00, -1.00,   JETNOS   453
     *            .10,   .80,  2.50,  2.20,   .80,  1.00,  0.00,  1.00,   JETNOS   454
     *           3.00,  3.30,  3.80,  3.80,  3.00,  2.50,  2.50,  2.50,   JETNOS   455
     *           6.00,  4.00,  2.80,  2.80,  3.00,  3.50,  4.00,  4.00,   JETNOS   456
     *           3.00,  1.90,   .60,  1.10,  2.00,  3.50,  5.00,  2.50,   JETNOS   457
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     *           .50,  -.40, -1.80, -1.20,   .10,  2.00,  4.00, -1.00,  JETNOS    458
     *           .20, -1.00, -3.30, -3.40, -2.60,  -.50,  1.50, -5.00,  JETNOS    459
     *           .20,  -.50, -3.20, -4.80, -6.00, -8.00,-10.00, -8.00,  JETNOS    460
     *           .20, -1.00, -3.30, -6.20, -9.50,-15.30,-21.40,-10.90,  JETNOS    461
     *        -19.80,-21.00,-23.30,-26.20,-29.50,-35.40,-41.00,-30.90/  JETNOS    462
      DATA C21/ -5.10, -6.80, -7.10, -8.20, -9.30, -7.70, -7.00, -9.90,  JETNOS    463
     *          -4.53, -5.97, -6.80, -7.63, -8.63, -7.53, -7.00, -9.00,  JETNOS    464
     *          -4.13, -5.33, -6.57, -7.17, -8.00, -7.30, -6.97, -8.33,  JETNOS    465
     *          -3.73, -4.80, -6.13, -6.57, -7.30, -6.93, -6.93, -7.53,  JETNOS    466
     *          -3.40, -4.23, -5.50, -5.93, -6.47, -6.40, -6.60, -6.67,  JETNOS    467
     *          -3.07, -3.67, -4.73, -5.03, -5.50, -5.80, -6.13, -5.67,  JETNOS    468
     *          -2.80, -3.07, -3.80, -3.90, -4.47, -4.80, -5.47, -4.67,  JETNOS    469
     *          -2.47, -2.40, -2.70, -2.63, -3.27, -3.73, -4.70, -3.67,  JETNOS    470
     *          -1.47, -1.26, -1.10, -1.17, -1.90, -2.60, -3.60, -2.67,  JETNOS    471
     *            .20,   .17,   .87,   .60,  -.33,  -.67, -1.67,  -.96,  JETNOS    472
     *            .90,  1.53,  2.83,  2.53,  1.47,  1.33,   .33,  1.00,  JETNOS    473
     *           2.33,  2.87,  3.70,  3.87,  3.33,  2.83,  2.93,  2.66,  JETNOS    474
     *           3.57,  2.67,  2.37,  2.67,  3.10,  3.67,  4.27,  4.00,  JETNOS    475
     *           1.17,   .57,  -.27,   .57,  1.93,  3.50,  5.00,  2.66,  JETNOS    476
     *           -.63, -1.56, -2.83, -1.90,  -.10,  2.00,  4.17,  1.00,  JETNOS    477
     *           -.87, -2.20, -4.30, -4.07, -2.83,  -.50,  1.67, -5.00,  JETNOS    478
     *           -.87, -2.00, -4.60, -5.60, -6.00, -7.17, -8.33, -8.00,  JETNOS    479
     *          -1.00, -2.10, -4.90, -7.10, -9.40,-13.60,-18.20,-11.00,  JETNOS    480
     *         -21.00,-22.10,-24.90,-27.20,-29.40,-33.50,-38.10,-31.00/  JETNOS    481
      DATA C22/ -5.60, -7.30, -8.40, -9.60, -9.10, -7.50, -7.00, -9.90,  JETNOS    482
     *          -5.27, -6.93, -7.80, -8.07, -8.27, -7.27, -7.00, -9.00,  JETNOS    483
     *          -5.07, -6.37, -7.43, -7.53, -7.70, -7.10, -6.93, -8.17,  JETNOS    484
     *          -4.87, -5.90, -6.87, -6.93, -7.00, -6.87, -6.87, -7.27,  JETNOS    485
     *          -4.70, -5.37, -6.20, -6.27, -6.13, -6.30, -6.60, -6.33,  JETNOS    486
     *          -4.53, -4.83, -5.37, -5.27, -5.10, -5.60, -6.06, -5.33,  JETNOS    487
     *          -4.30, -4.13, -4.30, -4.00, -3.93, -4.60, -5.33, -4.33,  JETNOS    488
     *          -3.73, -3.20, -3.00, -2.57, -2.63, -3.47, -4.40, -3.33,  JETNOS    489
     *          -1.93, -1.53, -1.20,  -.93, -1.20, -2.20, -3.20, -2.33,  JETNOS    490
     *           1.10,   .83,   .93,  1.00,   .33,  -.33, -1.33,  -.93,  JETNOS    491
     *           1.70,  2.27,  3.17,  2.87,  2.13,  1.67,   .67,  1.00,  JETNOS    492
     *           1.67,  2.43,  3.60,  3.93,  3.67,  3.17,  3.37,  2.83,  JETNOS    493
     *           1.13,  1.33,  1.93,  2.53,  3.20,  3.83,  4.53,  4.00,  JETNOS    494
     *           -.67,  -.77, -1.13,   .63,  1.87,  3.50,  5.00,  2.83,  JETNOS    495
     *          -1.77, -2.73, -3.87, -2.60,  -.30,  2.00,  4.33, -1.00,  JETNOS    496
     *          -1.93, -3.40, -5.30, -4.73, -3.07,  -.50,  1.83, -5.00,  JETNOS    497
     *          -1.93, -3.50, -6.00, -6.40, -6.00, -6.33, -6.66, -8.00,  JETNOS    498
     *          -2.00, -3.60, -6.80, -8.20, -8.90,-11.90,-14.70,-10.80,  JETNOS    499
     *         -22.00,-23.60,-26.80,-28.30,-28.90,-31.90,-34.60,-30.80/  JETNOS    500
      DATA C23/ -6.00, -8.50, -9.40, -9.30, -8.50, -7.20, -7.20,-10.20,  JETNOS    501
     *          -6.00, -7.90, -8.80, -8.50, -7.90, -7.00, -7.00, -9.00,  JETNOS    502
     *          -6.00, -7.40, -8.30, -7.90, -7.40, -6.90, -6.90, -8.00,  JETNOS    503
     *          -6.00, -7.00, -7.60, -7.30, -6.70, -6.80, -6.80, -7.00,  JETNOS    504
     *          -6.00, -6.50, -6.90, -6.60, -5.80, -6.20, -6.60, -6.00,  JETNOS    505
     *          -6.00, -6.00, -6.00, -5.50, -4.70, -5.40, -6.00, -5.00,  JETNOS    506
     *          -5.80, -5.20, -4.80, -4.10, -3.40, -4.40, -5.20, -4.00,  JETNOS    507
     *          -5.00, -4.00, -3.30, -2.50, -2.00, -3.20, -4.10, -3.00,  JETNOS    508
     *          -2.40, -1.80, -1.30,  -.70,  -.50, -1.80, -2.80, -2.00,  JETNOS    509
     *           2.00,  1.50,  1.00,  1.40,  1.00,  0.00, -1.00,  -.90,  JETNOS    510
     *           2.50,  3.00,  3.50,  3.20,  2.80,  2.00,  1.00,  1.00,  JETNOS    511
     *           1.00,  2.00,  3.50,  4.00,  4.00,  3.50,  3.80,  3.00,  JETNOS    512
     *          -1.30,  0.00,  1.50,  2.40,  3.30,  4.00,  4.80,  4.00,  JETNOS    513
     *          -2.50, -2.10, -2.00,  -.50,  1.80,  3.50,  5.00,  3.00,  JETNOS    514
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     *         -2.90, -3.90, -4.90, -3.30,  -.50,  2.00,  4.50, -1.00,    JETNOS
     *         -3.00, -4.60, -6.30, -5.40, -3.30,  -.50,  2.00, -5.00,    JETNOS
     *         -3.00, -5.00, -7.40, -7.20, -6.00, -5.50, -5.00, -8.00,    JETNOS
     *         -3.00, -5.40, -8.40, -8.90, -8.70,-10.60,-12.30,-11.00,    JETNOS
     *        -23.00,-25.40,-28.40,-29.00,-28.70,-30.70,-32.20,-31.00/    JETNOS
      DATA D24/ -7.00, -9.40,-10.40, -9.60, -8.00, -6.80, -7.30,-10.10,   JETNOS
     *         -6.93, -8.87, -9.80, -8.93, -7.53, -6.73, -7.00, -9.00,    JETNOS
     *         -6.93, -8.43, -9.17, -8.27, -7.10, -6.70, -6.87, -8.00,    JETNOS
     *         -7.13, -8.10, -8.33, -7.67, -6.40, -6.73, -6.73, -7.00,    JETNOS
     *         -7.30, -7.63, -7.60, -6.93, -5.46, -6.10, -6.60, -5.83,    JETNOS
     *         -7.47, -7.17, -6.63, -5.73, -4.30, -5.20, -5.93, -4.67,    JETNOS
     *         -7.30, -6.27, -5.30, -4.20, -2.87, -4.20, -5.07, -3.67,    JETNOS
     *         -6.27, -4.80, -3.60, -2.43, -1.37, -2.93, -3.80, -2.67,    JETNOS
     *         -2.87, -2.07, -1.40,  -.47,   .20, -1.40, -2.40, -1.67,    JETNOS
     *          2.90,  2.17,  1.07,  1.80,  1.67,   .33,  -.67,  -.87,    JETNOS
     *          3.30,  3.73,  3.83,  3.53,  3.47,  2.33,  1.33,  1.00,    JETNOS
     *           .33,  1.57,  3.40,  4.07,  4.33,  3.83,  4.23,  3.17,    JETNOS
     *         -3.73, -1.33,  1.07,  2.27,  3.40,  4.17,  5.07,  4.00,    JETNOS
     *         -4.00, -3.43, -2.87, -1.03,  1.73,  3.50,  5.00,  3.17,    JETNOS
     *         -4.03, -5.07, -5.93, -5.07,  -.70,  2.00,  4.67, -1.00,    JETNOS
     *         -4.07, -5.80, -7.30, -6.07, -3.53,  -.50,  2.17, -5.00,    JETNOS
     *         -4.07, -6.50, -8.80, -8.00, -6.00, -4.67, -3.33, -8.00,    JETNOS
     *         -4.10, -7.20,-10.30, -9.80, -8.40, -8.70, -8.80,-11.00,    JETNOS
     *        -24.00,-27.20,-30.30,-29.80,-28.40,-28.70,-28.80,-31.10/    JETNOS
C                                                                         JETNOS
      ALPHA=(ANGJET*1.745329E-2)-ATAN(GRAD)                               JETNOS
      ICODE=NJET                                                          JETNOS
      IF((NJET.GT.0).AND.(NJET.LE.3)) GO TO 250                           JETNOS
      IF(WS.NE.0.) DIAMET=0.                                              JETNOS
      ICODE=3                                                             JETNOS
      IF((PR.LE.0.0).AND.(PA.LE.0.0).AND.(TT.LE.0.0)) GO TO 250           JETNOS
      IF(WP.LE.0.0) ICODE=1                                               JETNOS
      IF(AP.LE.0.0) ICODE=2                                               JETNOS
  250 CALL JETPED(MCODE,ICODE,PR,PA,TT,VA,AP,WP,VP,DIAMET,AS,VS,ALPHA,    JETNOS
     *SPL,TIC,ANGLES,SPLP)                                                JETNOS
      IF((ICODE.NE.3).OR.(WS.EQ.0.0)) GO TO 500                           JETNOS
      AE=AP+AS                                                            JETNOS
      RHOE=WS/(AS*VS)                                                     JETNOS
C                                                                         JETNOS
C                                                                         JETNOS
      VE=VP*SQRT((1.+(AS/AP)*((VS/VP)**2))/(1.+AS/AP))                    JETNOS
C                                                                         JETNOS
C                                                                         JETNOS
      WE=RHOE*AE*(VE)                                                     JETNOS
C                                                                         JETNOS
      CALL JETPED(MCODE,ICODE,PR,PA,TT,VA,AE,WE,VE,0.0,0.0,VS,ALPHA,      JETNOS
     *SPL,TIC,ANGLES,SPLS)                                                JETNOS
  500 CONTINUE                                                            JETNOS
      RETURN                                                              JETNOS
      END                                                                 JETNOS
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      SUBROUTINE JETPED(ISN,IOPT,PR,PA,TT,V,A8,WA,                      JETPED
     *VA,DIAMET,A82,V2,ALPHA,SPL,TID,TTHETA,SPLPOS)                     JETPED
C AUTHOR             D. F. MELDRUM                                      JETPED
C                                                                       JETPED
C METHOD             JET NOISE IS PREDICTED BY THE USE OF SEVERAL CURVES JETPED
C                    THESE CURVES ARE INTERPOLATED OR EXTRAPOLATED AS   JETPED
C                    NEEDED INORDER TO PREDICT THE NOISE AT 150 FT RADIUS JETPED
C                                                                       JETPED
C PURPOSE            TO PREDICT THE JET NOISE PRODUCED BY 1) PRIMARY JET, JETPED
C                    2) SECONDARY JET.                                  JETPED
C                                                                       JETPED
C INPUTS             ISN        CODE FOR STRCUHAL CURVE REQUIRED        JETPED
C                                 1    FOR FLIGHT SPECTRUM CURVE        JETPED
C                                 2    FOR GROUND SPECTRUM CURVE        JETPED
C                                 3    FOR AVERAGE OF 1 AND 3           JETPED
C                    IOPT       CODE FOR TYPE OF INPUT DATA             JETPED
C                                 1    A8  PR  PA  TT  VELOCY (DIAMET)  JETPED
C                                 2    WA  PR  PA  TT  VELOCY (DIAMET)  JETPED
C                                 3    A8  WA  VA      VELOCY (DIAMET A82 JETPED
C                                                             VA2  WA2) JETPED
C                                 4    SECONDARY  (3)                   JETPED
C                    PR         NOZZLE PRESSURE RATIO                   JETPED
C                    PA         STATIC PRESSURE                         JETPED
C                    TT         TOTAL TEMPERATURE OF EXHAUST GAS        JETPED
C                    V          AIRCRAFT VELOCITY                       JETPED
C                    A8         CROSS-SECTIONAL AREA OF THE NOZZLE EXIT JETPED
C                    WA         WEIGHT FLOW OF EXHAUST GAS              JETPED
C                    VA         VELOCITY OF JET EXHAUST ABSOLUTE TO NOZZLE JETPED
C                    DIAMET     DIAMETER OF NOZZLE - IF ZERO OR NEGATIVE JETPED
C                               THE DIAMETER WILL BE CALCULATED FROM THE JETPED
C                               NOZZLE AREA                             JETPED
C                    A82        SECONDARY AREA (SEE A8)                 JETPED
C                    V2         SECONDARY ABSOLUTE VELOCITY OF JET EXHAUST JETPED
C                    ALPHA      ENGINE ATTITUDE ANGLE TO THE OBSERVER   JETPED
C                    TID        DIRECTIVITY CORRECTION CURVE            JETPED
C                    TTHETA     DIRECTIVITY ANGLES                      JETPED
C                                                                       JETPED
C                    INPUT VIA LABLED COMMON - GFREC                    JETPED
C                                                                       JETPED
C                    TFREQ    1/3 OCTAVE BAND CENTER FREQUENCIES        JETPED
C                                                                       JETPED
C OUTPUTS            SPL        SOUND PRESSURE LEVEL SPECTRA FOR JET NOISE JETPED
C                                                                       JETPED
C                    SPLPOS  MATRIX (24,17) OF UNSHIELDED SPECTRA       JETPED
C                    EITHER PRIMARY OR SECONDARY JET                    JETPED
C                                                                       JETPED
C MODIFICATIONS      FROM PROGRAM DESCRIBED IN D6-25490  MADE INTO      JETPED
C                    SUBROUTINE BY D. F. MELDRUM 4/15/72  FOR TEE215    JETPED
C                    TAKEN FROM TEE215 AND MADE CHANGES FOR THE         JETPED
C                    NASA-AMES CONTRACT                                 JETPED
C                                                                       JETPED
C REFERENCES         D6-25490             1/10/72  P. SCHORR            JETPED
C                    R. J. SAXBY,  JET NOISE PREDICTION PROCEDURE       JETPED
C                       FOR THE NASA-AMES FOOTPRINT CONTRACT NAS2-6969, JETPED
C                       UN-NUMBERED COORDINATION SHEET,  DATED          JETPED
C                       17 JANUARY 1973.                                JETPED
C                                                                       JETPED
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C FUNCTION SUBPRGM   ALOG10     TBLU1      TBLU2      TBLU3      SQRT     JETPED
C                    SIN        COS        PWRSUM                         JETPED
C                                                                         JETPED
C                                                                         JETPED
      COMMON /GFREQ/ IFREQ(24)                                            JETPED
C                                                                         JETPED
      DIMENSION TI(18,19,24),SPL(24,17),TTHETA(17)                        JETPED
      DIMENSION TRV(8),DEFREQ(24),ATHETA(19)                              JETPED
      DIMENSION TTEMP(20),TGMMA(20)                                       JETPED
      DIMENSION TVR(12),TDB(12)                                           JETPED
      DIMENSION TVRN(9),TDBN(9)                                           JETPED
      DIMENSION TCB(13),TSN(13),TSNL(13)                                  JETPED
      DIMENSION TCB2(13),TSN2(13),TSN2L(13)                               JETPED
      DIMENSION TCB3(11),TSN3(11),TSN3L(11)                               JETPED
      DIMENSION AREAX(6),SNX(36),SNLX(36),TVNRE(36,6)                     JETPED
      DIMENSION SPLPOS(24,17)                                             JETPED
C                                                                         JETPED
C                                                                         JETPED
C                                                                         JETPED
C     AREA RATIO CURVES                                                   JETPED
C                                                                         JETPED
      DATA AREAX/0.,1.,3.,6.,10.,15./                                     JETPED
      DATA SNX/.021,.026,.033,.042,.053,.067,.083,.104,.133,.167,         JETPED
     *         .208,.263,.333,.417,.525,.667,.833,1.04,1.33,1.67,         JETPED
     *           2.08,2.63,3.33,4.17,5.25,6.67,8.33,10.4,13.3,16.7,       JETPED
     *           20.8,26.3,33.3,41.7,52.5,66.7/                           JETPED
      DATA TVNRE/36*0.,                                                   JETPED
     *            3.5,4.5,3.9,3.35,2.75,2.2,1.67,1.2,.7,.45,.5,           JETPED
     *           .63,.85,1.,1.2,1.4,1.6,1.75,1.95,2.15,2.36,2.57,         JETPED
     *           2.77,3.05,3.18,3.38,3.58,3.77,3.98,4.17,4.37,4.57,       JETPED
     *           4.76,4.93,2*5.0,                                         JETPED
     *           .25,1.3,2.,1.9,1.26,.9,.75,.77,.94,1.05,1.2,             JETPED
     *           1.37,1.57,1.74,1.94,2.13,2.3,2.5,2.7,2.95,3.16,3.38,     JETPED
     *           3.61,3.80,4.05,4.26,4.48,4.7,4.9,7*5.,                   JETPED
     *           5*0.,.2,.47,.75,1.05,1.38,1.69,                          JETPED
     *           2.03,2.38,2.74,3.08,3.41,3.68,4.1,4.36,4.63,4.86,5.,     JETPED
     *           14*5.,6*C.0,.4,.78,1.24,1.65,2.07,2.43,                  JETPED
     *           2.81,3.16,3.46,3.78,4.03,4.26,4.48,4.68,4.78,4.86,       JETPED
     *           4.90,4.94,4.98,11*5.0,                                   JETPED
     *           4*0.0,.36,.75,1.13,1.6,2.17,2.64,3.11,3.59,4.,4.31,      JETPED
     *           4.56,4.77,4.89,19*5.C/                                   JETPED
C                                                                         JETPED
C                                                                         JETPED
      DATA TRV/500.,75C.,1000.,1250.,1500.,1750.,2000.,3000./             JETPED
C                                                                         JETPED
C     GAMMA VS TOTAL TEMPERATURE                                          JETPED
C                                                                         JETPED
      DATA TTEMP/2.,2.602,2.778,2.903,3.,3.079,3.146,3.204,3.255,3.301,   JETPED
     *      3.342,3.38C,3.415,3.447,3.477,3.505,3.531,3.556,3.580,3.602/  JETPED
      DATA TGMMA/1.4,1.4,1.392,1.387,1.369,1.357,1.344,1.330,1.324,1.316  JETPED
     *     ,1.310,1.304,1.3,1.296,1.293,1.290,1.287,1.285,1.283,1.281/    JETPED
C                                                                         JETPED
C     OASPL VS JET RELATIVE VELOCITY                                      JETPED
C                                                                         JETPED
      DATA TVR/2.699,2.945,3.301,3.347,3.362,3.398,                       JETPED
     *         3.431,3.462,3.491,3.544,3.602,3.699/                       JETPED
      DATA TDB/ 64.1, 97.3,146.1,152.5,154.2,158.3,161.0,                 JETPED
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     *          162.3,163.9,166.1,168.5,171.1/
C
C     DENSITY CORRECTION EXPONENT
C
      DATA TVRN/500.,1500.,1600.,1700.,1800.,1900.,2000.,2100.,
     *          2200./
      DATA TDBN/-0.40,1.4,1.59,1.77,1.88,1.95,1.99,2.00,2.0/
C
C     STROUHAL SPECTRUM  GRCUND  FLIGHT  MIXED
C
      DATA TCB/-33.5,-16.7,-12.5,-9.8,-8.,-5.5,-4.8,-4.8,-5.,
     1 -5.8,-8.7,-15.5,-45.3/
      DATA TSN/  .01,.04,.06,.C8,.1,.15,.2,.25,.3,.4,.7,2.,100./
      DATA TCB2/  -34.,-19.,-11.8,-9.5,-6.7,-5.8,-5.,-7.3,-10.9,
     1 -14.5,-20.6,-26.6,-45.2/
      DATA TSN2/  .01,.025,.04,.05,.C8,.1,.2,.5,1.,2.,5.,10.,100./
      DATA TCB3/  -38.,-14.5,-10.8,-7.7,-5.6,-5.2,-5.8,-7.3,
     1 -10.7,-15.3,-39.5/
      DATA TSN3/  .01,.07,.1,.15,.25,.4,.6,1.,2.,4.,100./
      DATA ISWTCH/0/
C
C
      IF(ISWTCH.NE.0) GO TO 33
      ISWTCH=1
C
      DC 34 I=1,36
      SNLX(I)=ALOG10(SNX(I))
      IF(I.GT.24) GO TO 34
      DEFREQ(I)=ALOG10(TFREQ(I)*2.C/1000.)
      IF(I.GT.19) GO TO 34
      ATHETA(I)=(I-1)*1C
      IF(I.GT.13) GO TO 34
      TSN1(I)=ALOG10(TSN(I))
      TSN21(I)=ALOG10(TSN2(I))
      IF(I.GT.11) GO TO 34
      TSN31(I)=ALOG10(TSN3(I))
   34 CCNTINUE
C
C
   33 IF(IOPT.EQ.3) GO TC 27
C
C
      GMMA=TBLU1(ALOG1C(TT),TTEMP,TGMMA,1,20)
      GAMEX=(GMMA-1.)/GMMA
      GAMX=(1.-GMMA)/GMMA
      RHO=(PA/(53.35*TT))*PR**GAMEX
      VJET=SQRT((64.4/GAMEX)*53.35*TT*(1.-PR**GAMX))
      VR=SQRT(VJET*VJET-2.0*VJET*V*COS(ALPHA)+V*V)
      VR1=ALOG10(VR)
      IF (IOPT .EQ. 2) GO TO 25
      XMACH=SQRT((2./(GMMA-1.))*((PR**GAMEX)-1.))
 3    IF (XMACH .LE. 1.) GC TO 20
      AREA=(A8*PR**(1./GMMA)*(2./(GMMA+1.))**(1./(GMMA-1.)))/
     1  SQRT(((GMMA+1.)/(GMMA-1.))*(1.-PR**GAMX))
      GC TO 35
 20   AREA=A8
      GC TO 35
```

```
 25   AREA=WA/(RHO*VJET)
      GO TO 35
C
C
   27 VR=SQRT(VA*VA-2.0*VA*V*COS(ALPHA)+V*V)
 29   AREA =A8
      RHO=WA/(A8*VA)
C
C     DETERMINE OASPL = DB + B
C
   35 VR1=ALOG10(VR)
      DB=TBLU1(VR1,TVR,TDB,1,12)
      AN=TBLU1(VR,TVRN,TDBN,1,9)
      B=10.*(ALOG10(AREA)+AN*ALOG10(RHO))
      DE=SQRT(AREA)*1.13
      IF(DIAMET.GT.0.0) DE=DIAMET
      DO 800 IOT=1,17
      DO 800 IOB=1,24
   43 FREQ=TFREQ(IOB)
      THETA=TTHETA(IOT)
      SN=FREQ*DE/VR
      SN1=ALOG10(SN)
      FREQDE=ALOG10(FREQ*DE/1000.)
C
C
      DELTA=0.
      IF(IOPT.NE.3) GO TO 44
      IF(A82.LE.0.) GO TO 44
      IF(V2.LE.0.) GO TO 44
      ABSRAT=ABS((VA-V2)/VA)
      IF(ABSRAT.LT.0.1) RETURN
      AREARO=A82/AREA
      SNX(1)  =  FREQ * DE / VA
      SNX1  =  ALOG10(SNX(1))
      IF  ((AREARO .LT. 1.) .AND. (SNX(1) .LT. 0.067))  AREARO = 1.
      AN=TBLU2(SNX1,AREARO,SNLX,AREAX,TVNRE,1,1,36,6,36,6)
      DELTA=AN*10.*ALOG10(ABSRAT)
C
C
   44 CONTINUE
C
      IF (ISN .EQ. 1) GO TO 47
      IF (ISN .EQ. 3) GO TO 45
      IF(ISN.NE.2) GO TO 47
      CB=TBLU1(SN1,TSN1,TCB,1,13)
      GO TO 156
   45 CB=TBLU1(SN1,TSN21,TCB2,1,13)
      GO TO 156
   47 CB=TBLU1(SN1,TSN31,TCB3,1,11)
  156 IF (VR-3000.) 49,49,28
   28 VR=3000.
      GO TO 49
   38 IF (VR-500.) 39,39,49
   39 VR=500.
CONTINUE
   49 XIO=TBLU3(VR,THETA,FREQDE,TRV,ATHETA,DEFREQ,TIO,1,1,1,
     *          8,19,24,8,19,24)
```

```
 8002 SPLPED=DB+B+CB+XID+DELTA-4.8
C
      SPLPOS(IOB,IOT)=SPLPED
      SPL(IOB,IOT)=PWRSUM(SPL(IOB,IOT),SPLPED)
  800 CONTINUE
      RETURN
C
C
      END
```

```
      SUBROUTINE JNSA(APY,APZ,ALTR,BCF,CZ,DELTA,DIAMT1,VP,VS,         JNSA
     *                SLDIST,M,NCF,SPLP,SPLS,SPLT,ITYPE,DSPL,IUNIT)   JNSA
C                                                                     JNSA
C     PURPOSE   TO PREDICT THE JET NOISE SHIELDING ATTENUATION FOR    JNSA
C               AN ENGINE-OVER-WING CONFIGURATION                     JNSA
C               THE ATTENUATIONS ARE TO BE SUBTRACTED FROM            JNSA
C               PREDICTED UNSHIELDED JET NOISE SPECTRA AT INDEXED     JNSA
C               CONDITIONS                                            JNSA
C                                                                     JNSA
C     INPUT                                                           JNSA
C               APY     ARRAY OF A/C COORDINATE IN DIRECTION OF       JNSA
C                       FLIGHT PATH PROJECTION ON THE GROUND(FT)      JNSA
C               APZ     ARRAY OF A/C VERTICAL COORDINATE ABOVE THE GROUND JNSA
C               SLDIST  SIDELINE POSITION OF OBSERVER                 JNSA
C               ALTR    OBSERVER HEIGHT ABOVE THE GROUND              JNSA
C               BCF     GEOMETRIC MEAN FREQUENCIES(HZ)                JNSA
C               CZ      AMBIENT SPEED OF SOUND(FPS) AT A/C ALTITUDE   JNSA
C                                                                     JNSA
C                       JET NOISE UNSHIELDED SPECTRUM                 JNSA
C               SPLP    FOR PRIMARY JET(TURBOJET,ITYPE=0) AND         JNSA
C               SPLS    FOR BULK FLOW JET TURBOFAN COANNULAR NOZZLE,  JNSA
C               ITYPE   (ITYPE=1)                                     JNSA
C                                                                     JNSA
C     INPUT     PRIMARY JET                                           JNSA
C               DELTA   ENGINE INCLINATION ANGLE(RAD)                 JNSA
C               DIAMT1  DIAMETER OF NOZZLE (FT)                       JNSA
C               DSL1    DIMENSIONLESS SHIELD LENGTH PARALLEL TO       JNSA
C                       EXHAUST AXIS FROM NOZZLE EXIT PLANE           JNSA
C               VP      VELOCITY OF JET EXHAUST RELATIVE TO NOZZLE(FPS) JNSA
C     INPUT     SECONDARY JET                                         JNSA
C               DIAMT2  DIAMETER OF NOZZLE(FT)                        JNSA
C               DSL2    DIMENSIONLESS SHIELD LENGTH PARALLEL TO       JNSA
C                       EXHAUST AXIS FROM NOZZLE EXIT PLANE           JNSA
C               VS      VELOCITY OF JET EXHAUST RELATIVE TO NOZZLE(FPS) JNSA
C                                                                     JNSA
C                                                                     JNSA
      DIMENSION APY(10,17),APZ(10,17),BCF(24),SLDIST(10),DSPL(24,17), JNSA
     *          SPLP(24,17),SPLS(24,17),SPLT(24,17)                   JNSA
C                                                                     JNSA
      COMMON/JNSHLD/DIAMT2,DSL1,DSL2                                  JNSA
C                                                                     JNSA
C     PRIMARY JET CASE(TURBOJET)                                      JNSA
C                                                                     JNSA
C     CONSTANT TERM OF REFERENCE CORRELATION TERM                     JNSA
C                                                                     JNSA
      CONST =DSL1*6.0E-7*CZ*CZ/(32.174*VP)+DSL1*2700.*DIAMT1*DIAMT1*  JNSA
     *32.174/(CZ*CZ*VP)                                               JNSA
      SNDE=SIN(DELTA)                                                 JNSA
      CSDE=COS(DELTA)                                                 JNSA
C                                                                     JNSA
C     CALCULATE JET NOISE SHIELDING ATTENUATION(PRIMARY JET)          JNSA
C                                                                     JNSA
      CALL JNSASP(APY,APZ,ALTR,BCF,SLDIST,M,NCF,CONST,SNDE,CSDE,DSPL) JNSA
C                                                                     JNSA
C     STORE SHIELDED JET NOISE SPECTRUM  THAT IS                      JNSA
C     UNSHIELDED PRIMARY JET NOISE SPECTRUM MINUS                     JNSA
C     THE JET NOISE SHIELDING(PRIMARY)ATTENUATION                     JNSA
```

```
C
      DO 300 J=1,17
      DO 300 I=1,NCF
      SPLP(I,J)= SPLP(I,J)-DSPL(I,J)
  300 CONTINUE
C
C     CHECK FOR PRIMARY AND SECONDARY(TURBOFANS
C     WITH COANNULAR NOZZLES)
C
      IF(ITYPE.EQ.2)GO TO 200
   66 RETURN
  200 CONTINUE
C
C     SECONDARY JET CASE(TURBOFAN)
C     CONSTANT TERM OF CORRELATION TERM
C
      DIAMTS=DIAMT2
      IF(IUNIT.EQ.0)DIAMTS=DIAMT2*3.280833
      CONST=DSL2*6.0E-7*CZ*CZ/(32.174*VS)+DSL2*2700.*DIAMTS*DIAMTS*
     *32.174/(CZ*CZ*VS)
C
C     CALCULATE JET NOISE SHIELDING ATTENUATION SECONDARY JET
C
      CALL JNSASP(APY,APZ,ALTR,BCF,SLDIST,M,NCF,CONST,SNCE,CSCE,DSPL)
C
C     FROM THE UNSHIELDED SPECTRUM  SUMMED ON AN ENERGY BASIS(SPLT)
C     IS SUBSTRACTED THE SHIELDED SPECTRUMS(PRIMARY AND SECONDARY)
C     GIVING THE JET SHIELDING ATTENUATION
C
      DO 400 J=1,17
      DO 400 I=1,NCF
      SPLS(I,J)=SPLS(I,J)-DSPL(I,J)
      DSPL(I,J)=SPLT(I,J)-10.*ALOG10(10.**(.1*SPLP(I,J))+
     *10.**(.1*SPLS(I,J)))
  400 CONTINUE
      GO TO 66
      END
```

```
      SUBROUTINE JNSASP(APY,APZ,ALTR,BCF,SLDIST,M,NCF,CONST,             JNSASP
     *                  SNDE,CSDE,DSPL)                                  JNSASP
C                                                                        JNSASP
C     PURPOSE  TO CALCULATE THE JET NOISE SHIELDING ATTENUATION          JNSASP
C              FOR AN EOW CONFIGURATION FOR BOTH TURBOJETS AND           JNSASP
C              TURBOFANS USING CO-ANNULAR NOZZLES                        JNSASP
C                                                                        JNSASP
C     INPUT    APY     ARRAY OF A/C COORDINATE IN DIRECTION OF           JNSASP
C                      FLIGHT PATHPROJECTION ON THE GROUND(FT)           JNSASP
C              APZ     ARRAY OF A/C VERTICAL COORDINATE ABOVE GROUND     JNSASP
C              ALTR    OBSERVER HEIGHT ABOVE THE GROUND                  JNSASP
C              BCF     GEOMETRIC MEAN FREQUENCIES ARRAY                  JNSASP
C              SLDIST  SIDELINE POSITION OF OBSERVER                     JNSASP
C              M       NO. OF SIDELINE OBSERVER POSITIONS                JNSASP
C              NCF     NO. OF GEOMETRIC MEAN FREQUENCIES                 JNSASP
C              CONST   CONSTANT PART OF REFERENCE CORRELATION TERM       JNSASP
C              SNDE    SINE OF THE ENGINE INCLINATION ANGLE              JNSASP
C              CSDE    COSINE OF ENGINE INCLINATION ANGLE                JNSASP
C                                                                        JNSASP
C     OUTPUT   DSPL    ARRAY OF JET NOISE SHIELDING ATTENUATION          JNSASP
C                                                                        JNSASP
      DIMENSION APY(10,17),APZ(10,17),BCF(24),DSPL(24,17),SLDIST(10)     JNSASP
C                                                                        JNSASP
C     FOR EACH FREQUENCY A FUNCTION OF EACH REFERENCE CORRELATION        JNSASP
C     TERM ITERATE FOR EACH A/C POSITION RELATIVE TO THE OBSERVER        JNSASP
C                                                                        JNSASP
      DO 200 I=1,NCF                                                     JNSASP
      ZDEO=CONST*BCF(I)                                                  JNSASP
C                                                                        JNSASP
C     ITERATE FOR EACH A/C POSITION RELATIVE TO THE OBSERVER             JNSASP
C     THAT IS FOR EACH OF 17 DIRECTION ANGLES                            JNSASP
C                                                                        JNSASP
      DO 100 J=1,17                                                      JNSASP
      ZEN=APZ(M,J)-ALTR                                                  JNSASP
      ARG1=SQRT(APY(M,J)*APY(M,J)+ZEN*ZEN)                               JNSASP
      ARG2=-APY(M,J)*CSDE-ZEN*SNDE                                       JNSASP
C                                                                        JNSASP
C     DIRECTION ANGLE CALCULATION                                        JNSASP
C                                                                        JNSASP
      THETA=1.570796327                                                  JNSASP
      IF(ARG1.GT.0.0)THETA=ACOS(ARG2/ARG1)                               JNSASP
      DEN=SQRT(SLDIST(M)*SLDIST(M)+APY(M,J)*APY(M,J)+ZEN*ZEN)            JNSASP
      ETA=ASIN(SLDIST(M)/DEN)                                            JNSASP
C                                                                        JNSASP
C     DIRECTIVITY EFFECT                                                 JNSASP
C                                                                        JNSASP
      ZEE=0.0                                                            JNSASP
      GRK=3.1415926-THETA                                                JNSASP
      IF(ABS(GRK).GT.1.0E-3)ZEE=ZDEO*COS(ETA)/(1.+.033*(THETA/GRK)**4)   JNSASP
C                                                                        JNSASP
C     JET NOISE SHIELDING ATTENUATION                                    JNSASP
C                                                                        JNSASP
  100 DSPL(I,J)= 10.*ALOG10(1.+ZEE)                                      JNSASP
  200 CONTINUE                                                           JNSASP
      RETURN                                                             JNSASP
      END                                                                JNSASP
```

```
      SUBROUTINE LGMTRY(NW,RADII,TLENG,EDH,TLOVH)
C
C AUTHOR              G. A. WEST
C
C PURPOSE             TO CALCULATE THE EFFECTIVE DUCT HEIGHT AND THE
C                     RATIO OF TREATED AREA TO CROSS SECTIONAL AREA
C                     FOR A DUCT LINING
C
C DESCRIPTION OF VARIABLES
C
C     VARIABLES IN COMMON - SEE MAIN PROGRAM
C
C     VARIABLES IN CALLING SEQUENCE
C
C      INPUT
C
C        NW       - NUMBER OF WALLS IN LINING
C        RADII    - RADII OF WALLS IN LINING
C        TLENG    - TREATMENT LENGTH OF WALLS IN LINING
C
C      OUTPUT
C
C        EDH      - EFFECTIVE DUCT HEIGHT
C        TLOVH    - RATIO OF TREATMENT LENGTH TO EFFECTIVE DUCT HEIGHT
C
C     LOCAL VARIABLES
C
C        AFLOW    - CROSS SECTIONAL FLOW AREA
C        I        - GENERAL DO LOOP INDEX
C        LASTW    - INDEX OF INNERMOST WALL THAT IS TREATED ON BOTH
C                   SIDES
C        PI       - MATHEMATICAL CONSTANT
C        SUM      - SUMMATION OF TREATMENT LENGTH OF ALL WALLS
C        TAREA    - TOTAL TREATED AREA
C        TL       - AVERAGE TREATMENT LENGTH
C        TLMAX    - MAXIMUM TREATMENT LENGTH OF A WALL
C        TLMIN    - MINUMUM TREATMENT LENGTH OF A WALL
C
C
      DIMENSION RADII(1),TLENG(1)
C
      DATA PI/3.141592€5/
C
C                                        CALCULATE THE CROSS SECTIONAL
C                                         AREA
      AFLOW = PI * RADII(1) * RADII(1)
      IF (NW .GT. 1) AFLOW = AFLOW - PI * RADII(NW) * RADII(NW)
C                                        CALCULATE THE TREATED AREA
      TAREA = 0.0
      DO 10 I=1,NW
      TAREA = TAREA + 2.0 * PI * RADII(I) * TLENG(I)
   10 CONTINUE
C                                        THE WALLS ARE TREATED ON BOTH
C                                         SIDES EXCEPT FOR THE OUTTER
C                                         AND INNERMOST WALLS.
      IF (NW .LE. 2) GO TO 25
C                                        ADD AREAS OF OTHER SIDES OF THE
```

```
C                                           INTERIOR WALLS                   LGMTRY
      LASTW = NW - 1                                                         LGMTRY
      DO 20 I=2,LASTW                                                        LGMTRY
      TAREA = TAREA + 2.0 * PI * RADII(I) * TLENG(I)                         LGMTRY
   20 CONTINUE                                                               LGMTRY
C                                          CALCULATE RATIO OF TREATED AREA   LGMTRY
C                                           TO CROSS SECTIONAL FLOW AREA     LGMTRY
C                                           (L/H)                            LGMTRY
   25 TLOVH = 0.325 * TAREA / AFLOW                                          LGMTRY
C                                          CALCULATE THE APPARENT TREATMENT  LGMTRY
C                                           LENGTH (L)                       LGMTRY
      TLMAX=TLENG(1)                                                         LGMTRY
      IF(NW .EQ. 1) GO TO 40                                                 LGMTRY
      TLMIN = TLMAX                                                          LGMTRY
      SUM = 0.0                                                              LGMTRY
      DO 30 I=1,NW                                                           LGMTRY
      IF(TLENG(I) .GT. TLMAX) TLMAX = TLENG(I)                               LGMTRY
      IF (TLENG(I) .LT. TLMIN) TLMIN = TLENG(I)                              LGMTRY
      SUM = SUM + TLENG(I)                                                   LGMTRY
   30 CONTINUE                                                               LGMTRY
C                                          IF THE RATIO OF THE LONGEST WALL  LGMTRY
C                                           TO THE SHORTEST WALL IS GREATER  LGMTRY
C                                           THAN 1.5 THE APPARENT TREATMENT  LGMTRY
C                                           LENGTH IS EQUAL TO THE LONGEST   LGMTRY
C                                           WALL.  OTHERWISE IT IS EQUAL TO  LGMTRY
C                                           THE AVERAGE LENGTH               LGMTRY
      IF (TLMAX/TLMIN .GE. 1.5) GO TO 40                                     LGMTRY
      TL   =   SUM / FLOAT(NW)                                               LGMTRY
      GO TO 50                                                               LGMTRY
C                                                                            LGMTRY
   40 TL = TLMAX                                                             LGMTRY
C                                          CALCULATE EFFECTIVE DUCT HEIGHT   LGMTRY
   50 ED  = TL/(TLOVH/0.65)                                                  LGMTRY
C                                                                            LGMTRY
      RETURN                                                                 LGMTRY
      END                                                                    LGMTRY
```

```
      SUBROUTINE LIFTFN                                                 LIFTFN
C AUTHOR           D. F. MELDRUM                                        LIFTFN
C                                                                       LIFTFN
C PURPOSE          TO PREDICT LIFT FAN NOISE FOR THE PHASE B            LIFTFN
C                  NASA-AMES FOOTPRINT CONTRACT NASA-6969.              LIFTFN
C                                                                       LIFTFN
C METHOD           AS DESCRIBED IN REFERENCE 1).                        LIFTFN
C                                                                       LIFTFN
C INPUTS           VIA LABLED COMMON LFTFAN                             LIFTFN
C                                                                       LIFTFN
C                  NB         NUMBER OF FAN BLADES FOR EACH STAGE       LIFTFN
C                             WHERE 1 <= I <= NUMSTG                    LIFTFN
C                  FPR        FAN PRESSURE RATIO                        LIFTFN
C                  DIAM       FAN INLET DIAMETER (INLET ONLY)  FT       LIFTFN
C                  RSS        MINIMUM ROTOR/STATOR SPACING     PERCENT  LIFTFN
C                  AREA       FAN DISCHARGE AREA (AFT ONLY)    FT*FT    LIFTFN
C                  RN1        ROTOR  SPEED                     RPM      LIFTFN
C                  RTS        RELATIVE TIP MACH NUMBER OF THE           LIFTFN
C                             FIRST STAGE WITHOUT INLET GUIDE           LIFTFN
C                             VANES (IGV).  IF LESS THAN 1              LIFTFN
C                             IGV WILL BE ASSUMED FOR THE FIRST         LIFTFN
C                             STAGE (INLET FAN ONLY).                   LIFTFN
C                  CRTFPR     FAN PRESSURE RATIO FOR THE                LIFTFN
C                             RELATIVE TIP MACH NUMBER OF               LIFTFN
C                             1.025 (INLET FAN ONLY)                    LIFTFN
C                  ANGLFT     ENGINE INCLINATION ANGLE                  LIFTFN
C                                                                       LIFTFN
C                  VIA LABLED COMMON SWITCH                             LIFTFN
C                                                                       LIFTFN
C                  NUMENG     NUMBER OF NOISE SOURCES OF THE SAME       LIFTFN
C                             NOISE TYPE.                               LIFTFN
C                                                                       LIFTFN
C                  VIA LABLED COMMON GCOMON                             LIFTFN
C                                                                       LIFTFN
C                  NCF        1/3 OCTAVE OF FULL OCTAVE SWITCH          LIFTFN
C                             OR NUMBER OF FREQUENCY BANDS (8 OR 24)    LIFTFN
C                  RETA(24)   DIRECTIVITY ANGLES                        LIFTFN
C                                                                       LIFTFN
C                  VIA LABLED COMMON GPRAM                              LIFTFN
C                                                                       LIFTFN
C                  AMACH      MACH NUMBER OF THE AIRCRAFT               LIFTFN
C                  NOBS       NUMBER OF OBSERVER POSITIONS              LIFTFN
C                                                                       LIFTFN
C                  VIA LABLED COMMON SUMSPL                             LIFTFN
C                                                                       LIFTFN
C                  SSPL       CURRENT TOTAL PREDICTED NOISE FOR NCF     LIFTFN
C                             (8 OR 24) FREQUENCIES, AT NOBS OBSERVER   LIFTFN
C                             POSITIONS FOR 17 DIRECTIVITY ANGLES.      LIFTFN
C                                                                       LIFTFN
C                  VIA LABLED COMMON ANGLE (SET UP BY SUBROUTINE ANGLES LIFTFN
C                                                                       LIFTFN
C                  PSI        17 DIRECTIVITY ANGLES FOR EACH OF         LIFTFN
C                             NOBS OBSERVER POSITIONS.                  LIFTFN
C                  PSIO       17 DIRECTIVITY ANGLE PROJECTIONS FOR      LIFTFN
C                             EACH OF NOBS OBSERVER POSITIONS           LIFTFN
C                  BETA       ELEVATION ANGLE PROJECTION FOR EACH       LIFTFN
C                             OF NOBS OBSERVER POSITIONS.               LIFTFN
```

```
C                                                                      
C                        EACH COMPONENT IS WRITTEN ON TAPE OR FILE 10  
C                        FOR EACH OF NCF BANDS FOR EACH OF NOBS OBSERVER
C                        POSITIONS.                                    
C                                                                      
C OUTPUTS                VIA LABLED COMMON SUMSPL                      
C                                                                      
C                        SSPL       CURRENT TOTAL PREDICTED NOISE FOR  
C                                   8 OR 24 FREQUENCIES, AT NOBS OBSERVER
C                                   POSITIONS FOR 17 DIRECTIVITY ANGLES.
C                                                                      
C                        VIA LABLED COMMON ANGLE (SET UP BY SUBROUTINE ANGLES
C                                                                      
C                        PSI        17 DIRECTIVITY ANGLES FOR EACH OF  
C                                   NOBS OBSERVER POSITIONS.           
C                        PSIO       17 DIRECTIVITY ANGLE PROJECTIONS FOR
C                                   EACH OF NOBS OBSERVER POSITIONS    
C                        BETA       ELEVATION ANGLE PROJECTION FOR EACH
C                                   OF NOBS OBSERVER POSITIONS.        
C                                                                      
C                                                                      
C                                                                      
C FUNCTION SUBPRGM       COS        ESHLOG      PWRSUM                 
C                                                                      
C SUBROUTINES            ANGLES     UNIT        FANNCS     ZERO        
C                                                                      
C                                                                      
C                                                                      
C                                                                      
C                                                                      
C                                                                      
      COMMON /LFTFAN/ NB,FPR,DIAM,RSS,AREA,RN1,RTS,CRTFPR,ANGLFT,
     *ICOR8,LINE8,NTF8,IMA8,LGM8,NWL8,IDP8,ILAY8,TF8(10),
     *PCTA8(10),PLA8(10),ELGH8,EDH8,R1H8(10),TL8(10),CF8,FM8
      COMMON/SWITCH/NTYPE,ITYPE,NENG,IDCP,IPRT(7),ICN(13),NLOPT
C     CONSTANTS USED IN INTERNAL CALCULATIONS
C
      COMMON /GCONST/ IN,IO,IT1,IT2,F0,F1,F2,F3,F4,F5,F6,F7,F8,F9,F10,
     *                I0,I1,I2,I3,I4,I5,I6,I7,I8,I9,I10,P1,P33,P5,P001,
     *                EPS,UNDEF,BL,ICO,DPR,RPD,ETA(17),M1,FM1,I17,A,PI
C
C     VARIABLE SET CALCULATED IN THE PROGRAM PROCESSING
C
      COMMON /GCOMON/ NCF,NK,BCF(24),TSPL(24,10,17),SPLT(24,17),
     *BUF(25),RETA(17),SPL2(17),TGAGR(24),DCPSF(17)
      COMMON/SUMSPL/SSPL(24,10,17)
      COMMON/PNLD/PSPL(17,20),EPNL(5,10),TEPNL(5,10)
C
C     FREQUENCY BANDS USED BY PROGRAM
C
      COMMON /GFREQ/ CFREQ(24),UFREQ(25),PFREQ(24)
C
C     GENERAL INPUT PARAMETERS
      COMMON/ANGLE/PSI(17,10),PSIO(17,10),BETA(17,10)
C
      COMMON /GPRAM/ALTP,ALTR,SLOPE,AMACH,NOBS,SLDIST(10),ITENG,IUNIT
     *    ,ISPTRM,IATMOS,IAIR,UAIRAB(24),NTEMP,TEMP(50),TALT(50)
```

```
     *    ,NPRES,PRES(50),PALT(50),NHUMID,RALT(50),RHUMID(50),CTEMP
     *    ,CPRES,CRHUMD,IEGA,IGDR,CTEMP,DPRES,DHUMID,XKN,ND,FLD(50),
     * ZNR(50),ZNI(50),LINECT,MAXLIN,IPAGE,BCG,TCG,FLR,AALT,EPF
C
C     AIRCRAFT-OBSERVER GEOMETRY OUTPUTS
C
      COMMON /GEOMO/ APY(10,17),APZ(10,17),PD(10,17),DPND(10,17),
     * B1(10,17),B2(10,17),TDS(17,10),TPC(17,10),IRR(10,17)
     *,APP,TP,RHP,APO,TO,RHO,CA,CZ,TSP(17,10),COV
C
C     CONVERSION CONSTANTS
C
      COMMON/GCONVC/C(2,10),SLDISX(10)
      COMMON/TMSPL/SPZ(24,17),IB(2,3,13)
      COMMON/CRSPLS/DOB(17),PSCR(17),DFB(408),NPSCR
      COMMON/HEAD/HIN(20),HOUT(20),CHIN(20)
C
C
      DIMENSION DEPNDB(17),VOVTIP(17)
C
C
      DATA VOVTIP/.0000,.0125,.0250,.0375,.0500,.0625,.0750,.0875,
     *            .1000,.1125,.1250,.1375,.1500,.1625,.1750,.2000,
     *            .2125/
      DATA DEPNDB/ 0.10, 1.50, 2.80, 3.95, 4.85, 5.60, 6.25, 6.75,
     *             7.15, 7.50, 7.80, 8.00, 8.17, 8.28, 8.32, 8.38,
     *             8.38/
C
C
C
      ICN(8)=ICN(8)+1
C
C
      DELTA=ANGLFT*RPD
      CALL ANGLES(NOBS,DELTA)
C
C
      NINLET=0
      NAFT=0
      IF(DIAM.GT.0.0) NINLET=1
      IF(AREA.GT.0.0) NAFT=1
      VO=(AMACH*CZ)*SIN(DELTA-ATAN(SLOPE))
      DX=DIAM
      IF(NINLET.LE.0) DX=SQRT(AREA/PI)
      VTIP=DX*RN1*PI/60.0
      IF  (VTIP .LE. 0.)  GO TO 40
      DELDB=TBLU1(VO/VTIP,VOVTIP,DEPNDB,1,17)
      DELDB=0.0
C
C
C     LOOP FOR THE NUMBER OF OBSERVER POSITIONS
C
   40 CONTINUE
      FBPF  =  FLOAT(NB) * RN1 / 60.
      DO 1000 M=1,NOBS
      CALL LINCOR(SPZ(1,1),IMAB,LGMB,ELCHB,EDHB,NWLB,R1WB,TLB,
     *      ILAYB,ZMB,IDPB,PSI(1,M),NCF,BCF,PLAB,
```

```
     *      CF8,PCTA8,NTF8,TF8,DOPSF,SFL2,ICOR8,IB(1,1,ITYPE),LIN8,FBPF)
C
      CALL ZERO(SPLT,408)
C
C
C
C     CALCULATE THE INLET FAN NOISE PREDICTION
C
      CALL FANNOS(DOPSF, PSI(1,M),SPLT(1,1),IDCP,1,NINLET,NAFT,NB,FPR,
     *               DIAM,RSS,AREA,RN1,RTS,CRTFPR,DELDB,0.0,0)
C
C
   45 CONTINUE
C
C     CONVERT TO A UNIT OR INDEXED SPECTRA
C
      CALL UNIT(150.,17,SPLT(1,1))
      ENG=NENG
      IF(ENG.LE.0.0) ENG=1.0
      ELVANG=90.0
      DANGLE=-45.0
      ENS=ESHLDG(DANGLE,ELVANG,ENG)
      DO 50 J=1,17
      DO 50 K=1,24
   50 SPLT(K,J)=SPLT(K,J)-ENS
      IF(NCF.EQ.24) GO TO 300
C
C     CONVERT 1/3 OCTAVE TO FULL OCTAVE
C
      DO 200 J=1,17
      DO 200 K=1,8
      TMP  =  0.
      DO 100 L=1,3
      JC   =   3 * K + L - 3
  100 TMP  =  PWRSUM(TMP, SPLT(JC,J))
  200 SPLT(K,J)  =   TMP
C
C
C     ADD TO CURRENT TOTAL AND WRITE ON TAPE 10
C
C
  300 DO 400 J=1,NCF
      DO 350 K=1,17
      SPLT(J,K)=SPLT(J,K)-SPZ(J,K)
  350 SSPL(J,M,K)=PWRSUM(SSPL(J,M,K),SPLT(J,K))
 400  CONTINUE
      IF(IPRT(7).NE.7)GO TO 410
      CALL NOISO(IPRT(7),M,NK,10,CHIN,ILNIT,SLDISX(M),PFREQ,SPLT(1,1),
     *  NCF,ITYPE)
 410  CONTINUE
      DO 360 JC=1,NCF
      DO 360 KC=1,17
 360  SPLT(JC,KC)=SPLT(JC,KC)-TSPL(JC,M,KC)
      CALL PNLSUB(SPLT(1,1),PSPL(1,M),TFC(1,M),EPNL(1,M),SPL2,
     *TEPNL(1,M),NK,BCG,TCG,FLR,M,NCBS,IPR(M,1))
      IF(IPRT(3).NE.3)GO TO 1000
      CALL NOISO(IPRT(3),M,NK,12,CHIN,ILNIT,SLDISX(M),PFREQ,
```

```
     *    SPLT(1,1),NCF,ITYPE)
C
C
C
 1000 CONTINUE
      RETURN
      END
```

```
      SUBROUTINE LINCOR(SP,I1,I2,A1,A2,I3,A3,A4,I4,A5,I5,A6,I6,A7,
     * A8,A9,A10,I7,A11,A12,A13,I8,I9,I10,A14)
C       SP=SPZ  I1=IMA& (& DENOTES NOISE MODULE NUMBER)
C       I2=LGM&    A1=ELOH&    A2=EDH&    I3=NWL&    A3=R1W&    A4=TL&
C       I4=ILAY&     A5=FM&      I5=IDP&    A6=PSI(1,I)    I6=NCF
C       A7=BCF        A8=PLA&     A9=CF&    A10=PCTA&    I7=NTF&   A11=TF&
C       A12=DDPSF     A13=SPL2    I8=ICCR&    I9=I8(1,1,ITYPE)    I10=LIN&
C       A14=FBPF
      COMMON/ICPATH/NCAS,NCCF,NTYP,IC,NRN,IARRAY(2)
      COMMON/SWITCH/NTYPE,ITYPE
      COMMON/ISWK/ISWT(3,13)
      DIMENSION SP(24,17),A3(1),A4(1),A6(17),A7(24),A8(1),
     * A10(1),A11(1),A12(1),A13(1),I9(2,3)
      DIMENSION SCR(17),SET(17)
      DATA SCR/17*1.0/
      ISWT(NCOF,ITYPE)=0
      DO 2 N=1,24
      DO 2 J=1,17
    2 SP(N,J)=0.
      IF(I10 .EQ. 0)GO TO 100
      IF(I7 .LE. 10)GO TO 4
      CALL ERROR(ITYPE,4,9)
      I7=10
    4 CONTINUE
      IF(I7 .GT. 0)GO TO 5
      I7=1
      A11(1)=A14
      A10(1)=100.0
    5 CONTINUE
      IF(I1 .EQ. 1 .OR. I2 .EQ. 0)GO TO 10
      IF(I3 .LE. 10) GO TO 6
      CALL ERROR(ITYPE,4,10)
      GO TO 100
    6 CONTINUE
      IF(I3 .EQ. 1)GO TO 10
      IF (I3 .GE. 2) GO TO 7
      CALL ERROR(ITYPE,4,11)
      GO TO 100
    7 CONTINUE
      DO 8 I=1,I3
    8 A3(I)=-A3(I)
      CALL SORTX(A3,A4,I3)
      DO 9 I=1,I3
    9 A3(I)=-A3(I)
   10 CONTINUE
      DO 11 I=1,17
      SET(I)=A12(I)
      IF(ITYPE.EQ.6.OR.ITYPE.EQ.9)SET(I)=SCR(I)
11    CONTINUE
      CALL LINING(SP(1,1),I1,I2,A1,A2,I3,A3,A4,I4,A5,I5,A6,I6,A7,
     * A8,A9,A10,I7,A11,SET,A13)
      GO TO 12
  100 CONTINUE
   12 CONTINUE
      IF(I8.EQ.0)GO TO 18
   17 CALL CORSPL(I8,I9(1,1),I6,A6,SP(1,1))
   18 CONTINUE
```

```
      IF(I10.NE.0)ISWT(NCOF,ITYPE)=10
      IF(I8.NE.0)ISWT(NCOF,ITYPE)=10
C     WRITE(10,3)ISWT(NCOF,ITYPE)
    3 FORMAT(1X,12HLINCOR ISWT=,I10)
   20 RETURN
      END
```

```
      SUBROUTINE LINING(ATNSPC,IUDMAX,LGEOM,ELOH,H,NW,RADII,TLNG,ILAY,     LINING
     *  DMCHNO,IDOPT,DANGLE,NCF,BCF,PEAK,SVEL,PCT,NTF,TF,DOPSFT,SPLC)      LINING
C                                                                          LINING
C AUTHOR              G. A. WEST, REVISED  21 JUN 72 BY D.G. DUNN          LINING
C                                                                          LINING
C PURPOSE             TO CALCULATE LINING ATTENUATION SPECTRA              LINING
C                                                                          LINING
C DESCRIPTION OF VARIABLES                                                 LINING
C                                                                          LINING
C     VARIABLES IN COMMON - SEE MAIN PROGRAM                               LINING
C                                                                          LINING
C     VARIABLES IN CALLING SEQUENCE                                        LINING
C                                                                          LINING
C      INPUT                                                               LINING
C                                                                          LINING
C        IUDMAX    - SPECIFIES WHETHER THE PROGRAM CALCULATES OR USER      LINING
C                    DEFINES THE PEAK LINING ATTENUATION.  EQUALS 0 IF     LINING
C                    PROGRAM CALCULATES, 1 IF USER DEFINES PEAK            LINING
C        LGEOM     - SPECIFIES WHETHER THE LINING ATTENUATION IS           LINING
C                    CALCULATED USING THE LINING GEOMETRY OR EFFECTIVE     LINING
C                    DUCT HEIGHT AND RATIO OF TREATMENT LENGTH TO DUCT     LINING
C                    HEIGHT.  EQUALS 1 FOR LINING GEOMETRY, 0 FOR          LINING
C                    EFFECTIVE DUCT HEIGHT AND RATIO OF TREATMENT LENGTH   LINING
C                    TO DUCT HEIGHT                                        LINING
C        ELOH      - RATIO OF TREATMENT LENGTH TO EFFECTIVE DUCT HEIGHT    LINING
C        H         - EFFECTIVE DUCT HEIGHT                                 LINING
C        NW        - NUMBER OF WALLS IN LINING                             LINING
C        RADII     - RADII OF WALLS IN LINING                              LINING
C        TLNG      - TREATMENT LENGTH OF WALLS                             LINING
C       ILAY      - = FOR SINGLE WALL LINING    =2 FOR DOUBLE WALL         LINING
C        DMCHNO    - DUCT MACH NUMBER                                      LINING
C        IDOPT     - INDICATES THE DESIGN POINT OPTION.  EQUALS 1 FOR      LINING
C                    SINGLE DESIGN POINT. 2 FOR MULTIPLE DESIGN POINT      LINING
C        DANGLE    - DIRECTIVITY ANGLE OF LINING                           LINING
C        NCF       - NUMBER OF BANDS IN SPECTRUM                           LINING
C        BCF       - ARRAY OF CENTER FREQUENCIES FOR BANDS IN SPECTRUM     LINING
C        PEAK      - PEAK ATTENUATION OF LINING DEFINED BY USER            LINING
C        SVEL      - SPEED OF SOUND IN DUCT                                LINING
C        PCT       - PERCENTAGE OF LINING TREATED FOR THE TARGET           LINING
C                    FREQUENCIES DEFINED IN ARRAY TF                       LINING
C        NTF       - NUMBER OF TARGET FREQUENCIES IN ARRAY TF              LINING
C        TF        - ARRAY OF TARGET FREQUENCIES                           LINING
C        DOPSFT    - DOPPLER SHIFT FACTOR, IE. 1.0 - AMACH * COS(THETA)    LINING
C                                                                          LINING
C      OUTPUT                                                              LINING
C        ATNSPC    - LINING ATTENUATION SPECTRUM                           LINING
C        SPLC      - PEAK ATTENUATION WHICH INCLUDES EFFECT OF DUCT        LINING
C                    MACH NUMBER, DESIGN RELEASE DATE, DIRECTIVITY ANGLE   LINING
C                    AND PERCENTAGE OF TOTAL LINING THAT IS TREATED        LINING
C                    FOR EACH TARGET FREQUENCY.                            LINING
C                                                                          LINING
C     LOCAL VARIABLES                                                      LINING
C                                                                          LINING
C        ALFHC     - LOGARITHM (BASE 10) OF RATIO OF                       LINING
C                    ((FREQUENCY * DUCT HEIGHT)/SPEED OF SOUND IN DUCT)    LINING
C        ALLOH     - LOGARITHM BASE 10 OF RATIO OF TREATMENT LENGTH TO     LINING
C                    DUCT HEIGHT                                           LINING
```

```
C        CONSTC     - COMPOSITE CORRECTION FACTOR WHICH INCLUDES THE       LINING
C                     EFFECT OF DUCT MACH NUMBER, DESIGN RELEASE DATE      LINING
C                     AND DIRECTIVITY ANGLE                                LINING
C        DANGLC     - CORRECTION FACTOR FOR DIRECTIVITY ANGLE              LINING
C        DUCTMC     - CORRECTION FACTOR FOR DUCT MACH NUMBER               LINING
C        EDH        - EFFECTIVE DUCT HEIGHT                                LINING
C        F9X        - ARRAY OF RATIOS OF TREATMENT LENGTH TO DUCT HEIGHT   LINING
C                     (LOG BASE 10)                                        LINING
C        F9Y        - ARRAY OF RATIOS OF ((TARGET FREQ * EFFECTIVE DUCT    LINING
C                     HEIGHT)/ SONIC VELOCITY)    (LOG BASE 10)            LINING
C        F9Z        - ARRAY OF PEAK ATTENUATIONS FOR CORRESPONDING         LINING
C                     VALUES IN F9X AND F9Y                                LINING
C      MD        - MACH NUMBER ARRAY FOR ATTENUATION CORRECTION FOR DUC LINING
C      LC        - LOG10(G) VALUES IN  ATTENUATION CORRECTION TABLE      LINING
C      LNTF      - FT H/C DIMENSIONLESS TARGET FREQ FOR ATTENUATION COR LINING
C      F10X      - MACH ARRAY FOR K     CORRECTION TABLE FOR SINGLE LIN LINING
C      F10Y      - K VALUES FOR SINGLE LAYER LININGS                     LINING
C      F11X      - SAME AS F10X FOR     DOUBLE LININGS                   LINING
C      F11Y      - SAME AS F10Y FOR    DOUBLE LININGS                    LINING
C        F13X       - ARRAY OF DIRECTIVITY ANGLES FOR CORRESPONDING        LINING
C                     CORRECTION FACTORS IN F13Y                           LINING
C        F13Y       - ARRAY OF DIRECTIVITY ANGLE CORRECTION FACTORS        LINING
C                     FOR CORRESPONDING DIRECTIVITY ANGLES IN F13X         LINING
C        I          - GENERAL DO LOOP INDEX                                LINING
C        J          - GENERAL DO LOOP INDEX                                LINING
C        SPLMAX     - PEAK LINING ATTENUATION                              LINING
C        TLOVH      - RATIO OF TREATMENT LENGTH TO EFFECTIVE DUCT HEIGHT   LINING
C                                                                          LINING
      REAL MD(13),LNTF(4),LC(13,4)                                         LINING
      DIMENSION ATNSPC(24,17),DCPSFT(1)                                    LINING
      DIMENSION              BCF(1),PEAK(1),PCT(1),TF(1),SPLC(1)           LINING
      DIMENSION DANGLE(1)                                                  LINING
      DIMENSION F10X(4),F10Y(4,2)                                          LINING
C                                                                          LINING
      DIMENSION RADII(1),TLNG(1)                                           LINING
      DIMENSION F9X(11),F9Y(6),F9Z(6,11)                                   LINING
      DIMENSION F11X(2),F11Y(2)                                            LINING
      DIMENSION F13X(11),F13Y(11)                                          LINING
C                                                                          LINING
      DATA ZERO /0.0/                                                      LINING
      DATA F9X/-1.0,-0.8,-0.6,-0.4,-0.2,0.0,0.2,0.4,0.6,0.8,1.0/           LINING
      DATA F9Y/-0.4,-0.2,0.0,0.2,0.4,0.6/                                  LINING
      DATA F9Z/ 1.3, 2.1, 2.5, 2.5, 2.1, 1.6,                              LINING
     1          2.5, 3.1, 3.5, 3.4, 2.8, 2.3,                              LINING
     2          4.0, 4.4, 4.7, 4.4, 3.7, 3.1,                              LINING
     3          5.6, 6.0, 6.2, 5.7, 4.8, 4.1,                              LINING
     4          7.8, 8.2, 8.2, 7.4, 6.2, 5.3,                              LINING
     5         10.7,11.2,10.9, 9.6, 8.1, 6.9,                              LINING
     6         15.5,15.5,14.4,12.3,10.3, 8.8,                              LINING
     7         22.0,22.0,19.3,16.0,13.4,11.2,                              LINING
     8         31.0,30.0,26.3,23.0,17.4,14.6,                              LINING
     9         46.5,43.0,37.0,29.5,23.5,18.5,                              LINING
     A         70.0,63.0,53.0,41.0,31.0,24.5/                              LINING
      DATA F10X/-.4,.4,.8,1./                                              LINING
      DATA F10Y/4*1.,.85,.95,2*1./                                         LINING
      DATA F11X/-.4,.4/                                                    LINING
      DATA F11Y/.85,.9/                                                    LINING
```

```
      DATA MD/-.8,-.6,-.5,-.4,-.3,-.2,-.1,0.,.1,.2,.3,.4,.6 /
      DATA LNTF/-.60206,-.30103,0.,.30103/
      DATA LC /.4942,.4928,.4814,.4609,.4216,.3522,.2201,0.,
     1         -.1175,-.2006,-.2652,-.3170,-.4001,.2253,.2227,.2175,
     2          .1959,.1644,.1206,.06446,0.,-.05799,-.1096,-.1549,
     3         -.1972,-.2782,.06070,.05690,.05308,.04922,.04139,
     4          .02938,.01703,0.,-.02411,-.04672,-.06651,-.08672,
     5          .1273,13*0.  /
      DATA F13X/30.0,50.0,70.0,90.0,110.0,115.0,120.0,130.0,140.0,150.0,
     1          160.0/
      DATA F13Y/0.45,0.70,0.88,1.00, 1.00, 0.98, 0.90, 0.62, 0.42, 0.29,
     1          0.21/
C
C
C                                        HAS THE USER DEFINED THE
C                                         MAXIMUM ATTENUATION FOR EACH
C                                         TARGET FREQUENCY
      DO 5 N=1,NCF
      DO 5 J=1,17
 5    ATNSPC(N,J)=ZERO
      FK=1.0
      IF (ILDMAX .EQ. 1) GO TO 35
C                                        PROGRAM IS TO CALCULATE MAXIMUM
C                                         ATTENUATION
C
C                                        HAS USER DEFINED THE EFFECTIVE
C                                         DUCT HEIGHT AND RATIO OF
C                                         TREATMENT LENGTH TO DUCT HEIGHT
C                                         OR IS THE PROGRAM TO CALCULATE
C                                         THESE QUANTATIES FROM LINING
C                                         GEOMETRY
      EDH = H
      TLOVH = ELOH
      IF (LGEOM .EQ. 1) CALL LGMTRY(NW,RADII,TLNG,EDH,TLOVH)
      ALLOH = ALOG10(TLOVH)
C                                        CALCULATE THE EFFECT OF DUCT
C                                         MACH NUMBER ON LINING
C   *      OBTAIN K CORRECTION
   10 CONTINUE
      IF(ILAY.EQ.1)GO TO 20
      FK=TBLU1(DMCHNO,F11X,F11Y,1,2)
      GO TO 30
 20   FK=TBLU1(DMCHNO,F10X,F10Y(1,IDCFT),1,4)
 30   CONTINUE
C  CALC (SPLC) ARRAY
C                                        OBTAIN CORRECTION FOR
C                                         DIRECTIVITY ANGLE
      HDC  =  EDH / SVEL
   35 CONTINUE
      DO 100 J=1,17
      DANGLC=TBLU1(DANGLE(J),F13X,F13Y,2,11)
      CONSTC=.01*DANGLC
      DO 60 I=1,NTF
      C=1.0
      SPLMAX = PEAK(I)
      IF (ILDMAX .EQ. 1) GO TO 50
      ALPHC = ALOG10(TF(I) * HDC)
```

```
      SPLMAX = TBLU2(ALFHC,ALLOH,F9Y,F9X,F9Z,2,2,6,11,6,11)
      IF (SPLMAX .LT. ZERO)  SPLMAX = ZERO
      IF(ALFHC.GE.LNTF(4)) GO TO 40
      C=10.**TBLU2(DMCHNO,ALFHC,MD,LNTF,LC,1,1,13,4,13,4)
 40   IF(ILAY.NE.1)GO TO 50
      C=C*FK
 50   C=CONSTC* C
      SPLC(I)=SPLMAX *C* PCT(I)
   60 CONTINUE
C
C                                       CALCULATE SPECTRUM
      CALL LININS(SPLC,TF,NTF,ATNSPC(1,J),BCF,ACF,FK,DOPSFT(J))
 100  CONTINUE
      RETURN
      END
```

```
      SUBROUTINE LININS(SPLC,TF,NTF,ATN,BCF,NCF,FK,DSFC)
C
C  AUTHOR              D.G. DUNN                 DATE- 13 JUNE 1972
C
C  PURPOSE             TO CALCULATE THE LINING ATTENUATION SPECTRUM SHAPE
C                      FOR MULTIPLE TARGET FREQUENCIES INCLUDING THE
C                      DOPPLER SHIFT.
C
C  DESCRIPTION OF VARIABLES
C
C  INPUTS
C    1) SPLC   ...  ARRAY OF PEAK ATTENUATION AT EACH TARGET FREQUENCY
C                   IN (DB). INCLUDES EFFECTS OF DUCT MACH NUMBER,
C                   DESIGN RELEASE DATE, DIRECTIVITY ANGLE, AND PER-
C                   CENTAGE OF TOTAL LINING THAT IS TREATED FOR EACH
C                   TARGET FREQUENCY.
C    2) TF     ...  ARRAY OF TARGET FREQUENCIES. (HZ)
C    3) NTF    ...  NUMBER OF TARGET FREQUENCIES.
C    4) BCF    ...  GEOMETRIC-MEAN FREQUENCIES FOR CONSTANT-PERCENTAGE-
C                   BAND ATTENUATION SPECTRUM. (HZ)
C    5) NCF    ...  NUMBER OF BANDS FOR ATTENUATION SPECTRUM.
C    6) W      ...  BANDWIDTH IN OCTAVES
C    7) DSFC   ...  DOPPLER SHIFT FACTOR, IE.
C                   DSFC  =  ONE - AMACH * COS(THETA)
C
C  OUTPUTS
C    1) ATN    ...  ARRAY OF (DB) VALUES FOR ATTENUATION SPECTRUM.
C
C.................................................................
      DIMENSION SPLC(1), TF(1), ATN(1), BCF(1)
      DIMENSION F12X(37), F12Y(37), F12XO(25), F12YO(25)
      DATA F12X /-24.0, -21.0, -18.0, -15.0, -12.0, -11.0, -10.0,  -9.0,
     1             -8.0,  -7.0,  -6.0,  -5.0,  -4.0,  -3.0,  -2.0,  -1.0,
     2            -0.7, -0.35,   0.0,  0.35,   0.7,   1.0,   2.0,   3.0,
     3             4.0,   5.0,   6.0,   7.0,   8.0,   9.0,  10.0,  11.0,
     4            12.0,  15.0,  18.0,  21.0,  24.0/
      DATA F12Y /0.007776,0.01296,0.0216,0.036,0.06,0.07,0.084,0.105,
     1            0.125,   0.16,   0.21,  0.28, 0.38,0.52,0.70, 0.89,
     2           0.935,   0.97,   0.99,  0.97, 0.935,.89,0.70, 0.52,
     3           0.38,    0.28,   0.21,  0.16, 0.125,.105,.084,0.07,
     4           0.06,    0.036,  0.0216,0.01296,   0.007776/
      DATA F12XO/-24.0, -21.0, -18.0, -15.0, -12.0, -10.5, -9.0,
     1            -7.5,  -6.0,  -4.5,  -3.0,  -1.5,   0.0,  1.5,
     2             3.0,   4.5,   6.0,   7.5,   9.0,  10.5, 12.0,
     3            15.0,  18.0,  21.0,  24.0/
      DATA F12YO/0.007776,0.01296,0.0216,0.036, 0.06, 0.075, 0.105,
     1           0.165,   0.24,   0.37,  0.55,  0.74, 0.92,  0.74,
     2           0.55,    0.37,   0.24,  0.165, 0.105,0.075, 0.06,
     3           0.036,   0.0216, 0.01295,.007776/
      DATA ZERO/0./
      DATA IW1/0/
C
C  ZERO-OUT (ATN) ARRAY
      IF(IW1.NE.0)GO TO 5
      W=1.0
      IF(NCF.NE.8)W=1./3.
      IW1=1
```

```
    5   CONTINUE
C
C  OUTTER LOOP FOR EACH TARGET FREQUENCY
        DO  50  I = 1,NTF
C
C  DEFINE CHARACTERISTIC FREQUENCY FOR DOPPLER FACTOR AND TARGET FREQ.
        FO  =  TF(I) / DSFC
C
C  INNER LOOP FOR EACH BAND OF ATTENUATION SPECTRUM
        DO  50  J = 1,NCF
C
C  CALCULATE THE NUMBER OF (1/3) OCTAVES BCF(J) IS FROM FO.
        OBAND  =   4.328085123 * ALOG(BCF(J) / FO)
        OBAND=OBAND *FK
C
C  CHECK FOR FULL OR (1/3) OCTAVE BAND ATTENUATION SPECTRUM SHAPING
        IF  (ABS(W - 1.0) - .002)  30, 30, 20
   20 SHAPE  =  TBLU1(OBAND, F12X, F12Y, 2, 37)
        GO TO 40
   30 SHAPE  =  TBLU1(OBAND, F12XC, F12YC, 2, 25)
   40 IF  (SHAPE .LT. ZERO)  SHAPE = ZERO
C
C  SUM ATTENUATIONS FOR EACH TARGET FREQUENCY AT EACH PASS BAND.
        ATN(J)  =  ATN(J) + SHAPE * SPLC(I)
   50 CONTINUE
        RETURN
        END
```

```
      FUNCTION MCHAR(XX)
C
C  AUTHOR              K.D. JOHNSON
C
C PURPOSE              RETURN THE NUMBER OF DIGITS LEFT OF THE DECIMAL
C                      POINT IN A FLOATING POINT NUMBER
C
      X=XX+.1
      MCHAR=INT(ALOG10(X))+1
      RETURN
      END
```

```
      SUBROUTINE MEASRD
C
      COMMON /GCONST/ IN,IO,IT1,IT2,F0,F1,F2,F3,F4,F5,F6,F7,F8,F9,F10,
     *                I0,I1,I2,I3,I4,I5,I6,I7,I8,I9,I10,P1,P33,P5,P001,
     *                EPS,UNDEF,BL,IOD,DPR,RPD,ETA(17),M1,FM1,I17,A,PI
C
C
      COMMON /MEASIN/ NEP,NPSI,NBETA,DELTA,EP(5),PSX(17),BETX(5),ICOR12
      COMMON /GCOMON/ NCF,NK,BCF(24),TSPL(24,10,17),SPLT(24,17),
     *BUF(25),RETA(17),SPL2(17),TGAGR(24),DUPSF(17)
C
C     FREQUENCY BANDS USED BY PROGRAM
C
      COMMON /GFREQ/ CFREQ(24),UFREQ(25),PFREQ(24)
      COMMON/SUMSPL/SSPL(24,10,17)
      COMMON/PNLD/PSPL(17,20),EPNL(5,10),TEPNL(5,10)
      COMMON/ANGLE/PSI(17,10),PSI0(17,10),BETA(17,10)
C
C     GENERAL INPUT PARAMETERS
C
      COMMON /GPRAM/ALTP,ALTR,SLOPE,AMACH,NOBS,SLDIST(10),NTENG,IUNIT
     *    ,ISPTRM,IATMOS,IAIR,UAIRAB(24),NTEMP,TEMP(50),TALT(50)
     *    ,NPRES,PRES(50),PALT(50),NHUMID,RALT(50),RHUMID(50),CTEMP
     *    ,CPRES,CRHUMD,IEGA,IGDR,DTEMP,DPRES,DHUMID,XKN,ND,FLD(50),
     * ZNR(50),ZNI(50),LINECT,MAXLIN,IPAGE,BCG,TCG,FLR,AALT,EPF
C
C     AIRCRAFT-OBSERVER GEOMETRY OUTPUTS
C
      COMMON /GEOMO/ APY(10,17),APZ(10,17),PD(10,17),DPND(10,17),
     * B1(10,17),B2(10,17),TDS(17,10),TPD(17,10),IRR(10,17)
     *,APP,TSO,RHP,APO,TO,RHO,CA,CZ,TSP(17,10),COV
      COMMON/HEAD/HIN(20),HOUT(20),CHIN(20)
      COMMON/SWITCH/NTYPE,ITYPE,NENG,IDCP,IPRT(7),ICN(13),NLOPT
      COMMON/GCONVC/C(2,10),SLDISX(10)
      COMMON/TMSPL/SPZ(24,17),IB(2,3,13)
      COMMON/CRSPLS/DOB(17),PSCR(17),DPB(408),NPSCR
      COMMON/ICPATH/NCAS,NCOF,NTYP,IC,NRN,IARRAY(2)
C     ****
C     ****
C     ****      DIMENSION SPL(425,24)
C     ****      DO 1 I=1,NEP
C     ****      DO 1 J=1,NPSI
C     ****      DO 1 K=1,NBETA
C     ****      INDEX=I+5*(J-1+17*(K-1))
C     ****    1 READ(----) (SPL(INDEX,L),L=1,NCF)
C     ****
C     ****
      DIMENSION SPL(425,24)
      REWIND 11
      IT=IN
      ICN(12)=ICN(12)+1
      IF(NCAS.NE.1)IT=11
      DO 621 K=1,NBETA
      DO 621 I=1,NEP
      DO 621 J=1,NPSI
      INDEX=I+5*(J-1+17*(K-1))
      READ(IT,625)(SPL(INDEX,L),L=1,NCF)
```

```
      IF(IT.EQ.11)GO TO 621
      WRITE(11,625)(SPL(INDEX,L),L=1,NCF)
 621  CONTINUE
  625 FORMAT(8F10.1)
 50   CONTINUE
      DELTAX=DELTA*0.01745
      CALL ANGLES(NOBS,DELTAX)
C
C
      DO 300 I=1,NOBS
      CALL LINCOR(SPZ(1,1),0,X,X,X,X,X,X,X,X,X,PSI(1,I),NCF,BCF,
     *  X,X,X,X,X,X,X,X,ICOR12,IB(1,1,ITYPE),0,X)
      DO 200 J=1,NCF
      DO 100 K=1,17
C
C
      SPLT(J,K)=TBLU3(EPF,PSI(K,I),BETA(K,I),EP,PSX,BETX,
     *                SPL(1,J),1,1,1,NEP,NPSI,NBETA,5,17,5) - SPZ(J,K)
  100 SSPL(J,I,K)=PWRSUM(SSPL(J,I,K),SPLT(J,K))
C
 200  CONTINUE
      IF(IPRT(7).NE.7)GO TO 220
      CALL NOISO(IPRT(7),I,NK,10,CHIN,IUNIT,SLDISX(I),PFREQ,
     *   SPLT(1,1),NCF,ITYPE)
 220  CONTINUE
      DO 240 NF=1,NCF
      DO 240 J=1,17
 240  SPLT(NF,J)=SPLT(NF,J)-TSPL(NF,I,J)
      IF(IPRT(3).NE.3)GO TO 300
      CALL PNLSUB(SPLT(1,1),PSPL(1,I),TPD(1,I),EPNL(1,I),SPL2,
     *  TEPNL(1,I),NK,BCG,TCG,FLR,I,NOBS,IRR(I,1))
      CALL NOISO(IPRT(3),I,NK,12,CHIN,IUNIT,SLDISX(I),PFREQ,
     *  SPLT(1,1),NCF,ITYPE)
 300  CONTINUE
      RETURN
      END
```

```
      SUBROUTINE MENOZZ(IEJECT,IENTRY,A,TS,AMACHJ,CV,AN,AMACHS,AR,PS,       MENOZZ
     *                  CO,PSO,THETA,FREC,SPL,XFREC)                        MENOZZ
C                                                                           MENOZZ
      DIMENSION FIG2(6,13),FIG2VR(6),FIG2AN(13)                             MENOZZ
      DIMENSION FIG2AV(2),FIG2A(2)                                          MENOZZ
      DIMENSION FIG3(10,2),FIG3FO(10)                                       MENOZZ
      DIMENSION FIG4(9,10),FIG4FO(9),FIG4AN(10)                             MENOZZ
      DIMENSION FIG5(6,11),FIG5VR(6),FIG5AN(11)                             MENOZZ
      DIMENSION FIG6(5),FIG6M(5)                                            MENOZZ
      DIMENSION FIG10(4),FI10VR(4)                                          MENOZZ
      DIMENSION FIG8(3),FIG8N(3)                                            MENOZZ
      DIMENSION FIG9(5),FIG9AR(5)                                           MENOZZ
      DIMENSION FIG7(8),FIG7AN(8)                                           MENOZZ
      DIMENSION FTEMP(9),FGAMMA(9)                                          MENOZZ
      DIMENSION SPL(24,17),FREQ(24),THETA(17)                               MENOZZ
C                                                                           MENOZZ
C                                                                           MENOZZ
      DATA FIG2VR/2.778,2.903,3.0,3.176,3.301,3.398/                        MENOZZ
      DATA FIG2AN/20.,40.,60.,80.,90.,100.,110.,120.,130.,140.,             MENOZZ
     *            150.,160.,170./                                           MENOZZ
      DATA FIG2  /106.0,108.8,111.8,118.0,123.1,127.7,                      MENOZZ
     *            106.3,109.3,112.2,119.0,125.0,129.9,                      MENOZZ
     *            106.4,109.5,112.8,120.5,127.1,132.9,                      MENOZZ
     *            106.5,110.0,113.8,122.8,130.0,135.5,                      MENOZZ
     *            106.6,111.0,115.3,125.1,133.2,139.1,                      MENOZZ
     *            107.5,112.3,117.0,128.0,136.7,143.0,                      MENOZZ
     *            110.5,115.2,120.0,131.0,140.0,146.3,                      MENOZZ
     *            113.3,118.2,123.0,134.5,143.9,150.0,                      MENOZZ
     *            116.7,121.7,126.8,138.5,148.2,154.6,                      MENOZZ
     *            118.7,124.0,129.4,142.4,153.0,159.5,                      MENOZZ
     *            120.4,126.0,131.9,145.7,156.2,163.0,                      MENOZZ
     *            119.5,125.0,130.7,144.1,154.7,161.0,                      MENOZZ
     *            117.8,123.0,128.3,140.9,151.0,157.7/                      MENOZZ
C                                                                           MENOZZ
C                                                                           MENOZZ
      DATA FIG2AV/ 650.,1950./                                              MENOZZ
      DATA FIG2A /1000.,1200./                                              MENOZZ
C                                                                           MENOZZ
C                                                                           MENOZZ
      DATA FIG3FO/-2.000,-1.699,-1.347,-1.097,-.6576,-.3010,0.000,          MENOZZ
     *             .4771, .9031, 1.301/                                     MENOZZ
      DATA FIG3  / -37.3, -29.4, -20.3, -14.3,  -9.5, -11.7, -15.9,         MENOZZ
     *             -23.6, -31.0, -37.8,                                     MENOZZ
     *             -37.3, -29.4, -20.3, -14.3,  -8.8, -11.7, -18.7,         MENOZZ
     *             -30.9, -41.8, -52.3/                                     MENOZZ
C                                                                           MENOZZ
C                                                                           MENOZZ
      DATA FIG4FO/-2.0,-1.523,-1.155,-.699,-.222,.301,.845,1.398,2.0/       MENOZZ
      DATA FIG4AN/0.,100.,110.,120.,130.,135.,140.,150.,160.,170./          MENOZZ
      DATA FIG4  / 8.4, 5.1, 2.1,0.0, 1.2, 3.9,  5.8,  7.0,  8.0,           MENOZZ
     *             8.4, 5.1, 2.1,0.0, 1.2, 3.9,  5.8,  7.0,  8.0,           MENOZZ
     *             4.4, 3.3, 1.4,0.0, 1.0, 3.4,  5.2,  6.3,  7.0,           MENOZZ
     *             3.0, 2.5, 1.0,0.0, 0.7, 3.0,  4.6,  5.7,  6.4,           MENOZZ
     *             0.0, 0.0, 0.0,0.0, 0.3, 1.3,  2.2,  2.7,  3.2,           MENOZZ
     *             0.0, 0.0, 0.0,0.0, 0.0, 0.0,  0.0,  0.0,  0.0,           MENOZZ
     *            -1.3,-1.0,-0.6,0.0,-0.5,-1.3, -1.9, -2.3, -2.7,           MENOZZ
     *            -4.0,-2.9,-1.6,0.0,-1.7,-4.0, -5.8, -7.0, -8.2,           MENOZZ
```

```
     *          -6.6,-4.2,-2.2,0.0,-2.5,-6.7,-10.3,-13.7,-17.0,         MENOZZ
     *          -9.6,-6.0,-2.8,0.0,-3.9,-9.7,-14.6,-18.8,-23.0/         MENOZZ
C                                                                       MENOZZ
C                                                                       MENOZZ
      DATA FIG5VR/500.,800.,1000.,1250.,1500.,2000./                    MENOZZ
      DATA FIG5AN/20.,40.,60.,80.,100.,110.,120.,130.,140.,150.,160./   MENOZZ
      DATA FIG5  /1.22,1.28,1.36,1.50,1.65,1.86,                        MENOZZ
     *            1.24,1.34,1.43,1.57,1.72,1.95,                        MENOZZ
     *            1.26,1.42,1.54,1.70,1.86,2.14,                        MENOZZ
     *            1.32,1.57,1.76,1.95,2.14,2.40,                        MENOZZ
     *            1.37,1.68,1.89,2.12,2.34,2.66,                        MENOZZ
     *            1.37,1.57,1.74,1.92,2.11,2.47,                        MENOZZ
     *            1.32,1.36,1.41,1.48,1.55,1.64,                        MENOZZ
     *            1.08,1.10,1.12,1.14,1.16,1.22,                        MENOZZ
     *             .84, .86, .86, .88, .90, .96,                        MENOZZ
     *             .68, .70, .70, .72, .74, .78,                        MENOZZ
     *             .58, .60, .61, .63, .64, .71/                        MENOZZ
C                                                                       MENOZZ
C                                                                       MENOZZ
      DATA FIG6M/0.,.4,.8,1.2,1.5/                                      MENOZZ
      DATA FIG6 /1.31,1.24,1.07, .75, .45/                              MENOZZ
C                                                                       MENOZZ
C                                                                       MENOZZ
      DATA FI10VR /600.,1200.,1600.,2000./                              MENOZZ
      DATA FIG10  / 6.4, 25.4, 36.0, 45.0/                              MENOZZ
C                                                                       MENOZZ
C                                                                       MENOZZ
      DATA FIG8N/0.903,1.602,2.301/                                     MENOZZ
      DATA FIG8 /  -5., -10., -15./                                     MENOZZ
C                                                                       MENOZZ
C                                                                       MENOZZ
      DATA FIG9AR/.079,.301,.362,.602,1.161/                            MENOZZ
      DATA FIG9  /-7.6,-3.9,-3.2,-1.3, 3.0/                             MENOZZ
C                                                                       MENOZZ
C                                                                       MENOZZ
      DATA FIG7AN/  10.,  35.,  55.,  80., 100., 125., 150., 170./      MENOZZ
      DATA FIG7  /-15.0,-12.3, -8.4, -1.9,  2.9,  6.0,  2.6, -4.0/      MENOZZ
C                                                                       MENOZZ
C                                                                       MENOZZ
      DATA FTEMP / 800., 900.,1000.,1200.,1400.,1600.,1800.,2000.,2500./ MENOZZ
      DATA FGAMMA/1.382,1.376,1.369,1.357,1.344,1.333,1.324,1.316,1.302/ MENOZZ
C                                                                       MENOZZ
      DATA SPHDIV/33.2/,G/32.174/,R/53.345/                             MENOZZ
C                                                                       MENOZZ
      IF(IENTRY.EQ.2) GO TO 200                                         MENOZZ
      GAMMA=TBLU1(TS,FTEMP,FGAMMA,1,9)                                  MENOZZ
      CJ=SQRT(GAMMA*G*R*TS)                                             MENOZZ
      XPS=PS*144.                                                       MENOZZ
      IF(IEJECT.EQ.0) XPS=PSC*144.0                                     MENOZZ
      RHO=XPS/(R*TS)                                                    MENOZZ
      VJET=CV*CJ*AMACHJ                                                 MENOZZ
      VS=CO*AMACHS                                                      MENOZZ
      UE=VJET-VS+0.4*CO                                                 MENOZZ
      TSO=TBLU1(VJET,FIG2AV,FIG2A,1,2)                                  MENOZZ
      V2=ALOG10(UE)                                                     MENOZZ
      FUN1=TBLU1(AMACHJ,FIG6M,FIG6,2,5)                                 MENOZZ
      FUN2=10.0*ALOG10(RHO*RHO*A*(TS/TSO)**1.5)                         MENOZZ
```

```
      V3   =   VJET + (VS - 0.4 * CC)
      FUN5   =   VJET*VJET / (V3 * 1.13 * SQRT(A / AN))
      FUN7=FUN2+TBLU1(ALOG10(AN),FIG8N,FIG8,1,3)
     *          +TBLU1(ALOG10(AR),FIG9AR,FIG9,1,5)
     *          +SPHDIV+TBLU2(V2,120.0,FIG2VR,FIG2AN,FIG2,1,1,6,13,6,13)
      XFREQ=FUN5*FUN1*TBLU2(UE,120.0,FIG5VR,FIG5AN,FIG5,1,1,
     *                       6,11,6,11)*0.3
C
C
      DO 100 I=1,17
C
C
      FC2=FUN5*FUN1*TBLU2(UE,THETA(I),FIG5VR,FIG5AN,FIG5,1,1,6,
     *                          11,6,11)
C
C
      OASPL2=FUN7+TBLU1(THETA(I),FIG7AN,FIG7,2,8)
C
C
      DO 100 J=1,24
      FREQ2=ALOG10(FREQ(J)/FC2)
C
C
C
  100 SPL(J,I)=OASPL2+TBLU1(FREQ2,FIG3F0,FIG3(1,2),2,10)
     *    +TBLU2(FREQ2,THETA(I)+10.0,FIG4F0,FIG4AN,FIG4,2,1,9,10,9,10)
      RETURN
C
C
  200 V0=C0*AMACHS
      VE=SQRT(VJET*VJET-2.0*VJET*VC*COS(AN)+VC*VC)
      FUN3=FUN2
      V3   =   SQRT(VJET*VJET + 2.*VJET*VC*COS(AN) + VC*VC)
      FUN6=-0.34*TBLU1(VE,FI10VR ,FIG10,1,4)*SQRT(AR-1.0)
C
C
      IF(IEJECT.EQ.0) GO TO 250
      PGAMMA=TBLU1(TS,FTEMP,FGAMMA,1,5)
      PCJ=SQRT(PGAMMA*G*R*TS)
      PRHO=PS0*144.0/(R*TS)
      PVJET=CV*PCJ*AMACHJ
      VE=SQRT(PVJET*PVJET-2.0*PVJET*VC*COS(AN)+VC*V0)
      PTS0=TBLU1(PVJET,FIG2AV,FIG2A,1,2)
      FUN3=10.0*ALOG10(PRHO*PRHO* PS*(TS/PTS0)**1.5)
      V3   =   SQRT(PVJET*PVJET + 2.*PVJET*VC*COS(AN) + VC*VC)
      FUN4   =   PVJET*PVJET / (V3 * 1.13 * SQRT(PS))
      FUN6=0.0
C
C
  250 V1=ALOG10(VE)
C
C
C
      DO 300 I=1,17
C
C
      F01=FUN4*TBLU2(VE,THETA(I),FIG5VR,FIG5AN,FIG5,1,1,6,11,6,11)
```

```
C
C
      OASPL1=FUN3+FUN6
     *        +SPHDIV+TBLU2(V1,THETA(I),FIG2VR,FIG2AN,FIG2,1,1,6,13,6,13)
C
C
      DO 300 J=1,24
      FREQ1=ALOG10(FREQ(J)/F01)
C
C
  300 SPL(J,I)=OASPL1+TBLU1(FREQ1,FIG3F0,FIG3,2,10)
     *           +TBLU2(FREQ1,THETA(I),FIG4F0,FIG4AN,FIG4,2,1,9,10,9,10)
C
      RETURN
      END
```

```
      SUBROUTINE NEXTCR                                                 NEXTCR
C                                                                       NEXTCR
C     CONSTANTS USED IN INTERNAL CALCULATIONS                           NEXTCR
C                                                                       NEXTCR
      COMMON/SWITCH/NTYPE,ITYPE,NENG,IDCP,IPRT(7),ICN(13),NLCPT         NEXTCR
      COMMON /GCONST/ IN,IO,IT1,IT2,FC,F1,F2,F3,F4,F5,F6,F7,F8,F9,F10,  NEXTCR
     *               I0,I1,I2,I3,I4,I5,I6,I7,I8,I9,I10,PL,C33,P5,POOL,  NEXTCR
     *               EPS,UNDEF,BL,ICD,DPR,RPD,ETA(17),M1,FM1,I17,A,PI   NEXTCR
C                                                                       NEXTCR
C     VARIABLE SET CALCULATED IN THE PROGRAM PROCESSING                 NEXTCR
C                                                                       NEXTCR
      COMMON /GCOMON/ NCF,NK,BCF(24),TSPL(24,10,17),SPLT(24,17),        NEXTCR
     *BUF(25),RETA(17),SPL2(17),TGAGR(24),DOPSF(17)                     NEXTCR
C                                                                       NEXTCR
C     FREQUENCY BANDS USED BY PROGRAM                                   NEXTCR
C                                                                       NEXTCR
      COMMON /GFREQ/ CFREQ(24),UFREQ(25),PFREQ(24)                      NEXTCR
C                                                                       NEXTCR
C     GENERAL INPUT PARAMETERS                                          NEXTCR
C                                                                       NEXTCR
      COMMON /GPRAM/ALTP,ALTR,SLOPE,AMACH,NOBS,SLDIST(10),ITENG,IUNIT   NEXTCR
     *    ,ISPTRM,IATMOS,IAIR,UAIRAB(24),NTEMP,TEMP(50),TALT(50)        NEXTCR
     *    ,NPRES,PRES(50),PALT(50),NHUMID,RALT(50),RHUMID(50),CTEMP     NEXTCR
     *    ,CPRES,CRHUMC,IEGA,IGDR,DTEMP,DPRES,CHUMIC,XKN,NC,FLD(50),    NEXTCR
     * ZNR(50),ZNI(50),LINECT,MAXLIN,IPAGE,BCG,TCG,FLR,AALT,EPF         NEXTCR
C                                                                       NEXTCR
C     AIRCRAFT-OBSERVER GEOMETRY OUTPUTS                                NEXTCR
C                                                                       NEXTCR
      COMMON /GEOMO/ APY(10,17),APZ(10,17),PD(10,17),DPND(10,17),       NEXTCR
     * B1(10,17),B2(10,17),TDS(17,10),TPD(17,10),IRR(10,17)             NEXTCR
     *,APP,TP,RHP,APO,TO,RHO,CA,CZ,TSP(17,10),CCV                       NEXTCR
C                                                                       NEXTCR
C     CONVERSION CONSTANTS                                              NEXTCR
C                                                                       NEXTCR
      COMMON/GCONVC/C(2,10),SLDISX(10)                                  NEXTCR
      COMMON/CRSPLS/DOB(17),PSCR(17),CPB(408),NPSCR                     NEXTCR
      DIMENSION XL(2)                                                   NEXTCR
      DATA XL/2HM.,2HFT/                                                NEXTCR
C                                                                       NEXTCR
C     DETERMINE AVERAGE AIR ABSORPTION COEFFICIENTS                     NEXTCR
 40   IF(IAIR.EQ.M1) GO TO 150                                          NEXTCR
      IF(IAIR.EQ.I1)GO TO  150                                          NEXTCR
      ALTZ=ALTR+AALT                                                    NEXTCR
      ALTW=ALTP+AALT                                                    NEXTCR
      CALL AVGALF(ALTZ,ALTW,NK,NCF,BCF,UAIRAB,IATMOS)                   NEXTCR
 150  IF(IPRT(5).NE.5)GO TO 155                                         NEXTCR
      CALL PRINTH(IPRT(5),LCT,9)                                        NEXTCR
      WRITE(9,20)                                                       NEXTCR
 20   FORMAT(50X,31HNOISE EXTRAPOLATION CORRECTIONS// )                 NEXTCR
      WRITE(9,22)                                                       NEXTCR
 22   FORMAT(2X,46HSPHERICAL DIVERGENCE (APPLYS TO ALL PASSBANDS)/)     NEXTCR
      WRITE(9,24)XL(IUNIT+1)                                            NEXTCR
 24   FORMAT(6X,1HX,44X,32HSOUND PRESSURE LEVEL ATTENUATION /5X,1H(,A2, NEXTCR
     *      1H),56X,4H(DB) /)                                           NEXTCR
      LCT=13                                                            NEXTCR
 155  CONTINUE                                                          NEXTCR
C     SPHERICAL DIVERGENCE CALCULATIONS                                 NEXTCR
```

```
      DO 300 I=I1,NOBS                                                   NEXTCR
      DO 200 J=I1,I17                                                    NEXTCR
      IF(PD(I,J).NE.F0)GO TO 160                                         NEXTCR
      SPLT(I,J)=F0                                                       NEXTCR
      GO TO 170                                                          NEXTCR
  160 CONTINUE                                                           NEXTCR
      SPLT(I,J)=20.* ALOG10(ABS(PD(I,J)*C(I2,I1)))                       NEXTCR
  170 CONTINUE                                                           NEXTCR
      DO 180 K=I1,NCF                                                    NEXTCR
  180 TSPL(K,I,J)=SPLT(I,J)                                              NEXTCR
  200 CONTINUE                                                           NEXTCR
      IF(IPRT(5).NE.5)GO TO 300                                          NEXTCR
      WRITE(9,250)SLDISX(I),(SPLT(I,J),J=I1,I17)                         NEXTCR
  250 FORMAT(2X,1PE10.3,0PF7.1,16F7.1)                                   NEXTCR
  300 CONTINUE                                                           NEXTCR
      IF(IPRT(5).NE.5)GO TO 310                                          NEXTCR
      WRITE(9,275)(ETA(J),J=I1,I17)                                      NEXTCR
  275 FORMAT(/3X,8HANGLE XI /4X,5H(DEG),2X,17F7.0//)                     NEXTCR
      LCT=LCT+NOBS+5                                                     NEXTCR
  310 CONTINUE                                                           NEXTCR
C     CALCULATION OF ATMOSPHERIC ABSORPTION                              NEXTCR
      DO 400 I=I1,NOBS                                                   NEXTCR
      DO 400 K=I1,NCF                                                    NEXTCR
      DO 350 J=I1,I17                                                    NEXTCR
      SPL2(J)=UAIRAB(K)*PD(I,J)*PCC1                                     NEXTCR
  350 TSPL(K,I,J)=TSPL(K,I,J)+SPL2(J)                                    NEXTCR
      IF(IPRT(5).NE.5) GO TO 400                                         NEXTCR
      IF(LCT.GE.54) GO TO 360                                            NEXTCR
      IF(K.EQ.1)GO TO 370                                                NEXTCR
      GO TO 390                                                          NEXTCR
  360 CALL PRINTH(IPRT(5),LCT,S)                                         NEXTCR
      WRITE(9,20)                                                        NEXTCR
      LCT=8                                                              NEXTCR
  370 WRITE(9,380)SLDISX(I),XL(IUNIT+1)                                  NEXTCR
      LCT=LCT+1                                                          NEXTCR
  380 FORMAT(2X,32HATMOSPHERIC ABSORPTION   FOR X =,1PE10.3,1X,A2)       NEXTCR
      WRITE(9,382)                                                       NEXTCR
  382 FORMAT(/3X,9HFREQUENCY,39X,32HSOUND PRESSURE LEVEL ATTENUATION/    NEXTCR
     *      5X,5H(  ),55X,4H(DB)/)                                       NEXTCR
      LCT=LCT+ 4                                                         NEXTCR
  390 WRITE(9,250)PFR (K),(SPL2(J),J=I1,I17)                             NEXTCR
      LCT=LCT+1                                                          NEXTCR
      IF(K.NE.NCF)GO TO 400                                              NEXTCR
      IF(LCT.GT.49)GO TO 395                                             NEXTCR
  392 WRITE(9,275)(ETA(J),J=I1,I17)                                      NEXTCR
      LCT=LCT+5                                                          NEXTCR
      GO TO 400                                                          NEXTCR
  395 CALL PRINTH(IPRT(5),LCT,S)                                         NEXTCR
      WRITE(9,20)                                                        NEXTCR
      LCT=LCT+3                                                          NEXTCR
      WRITE(9,380)SLDISX(I),XL(IUNIT+1)                                  NEXTCR
      LCT=LCT+1                                                          NEXTCR
      GO TO 392                                                          NEXTCR
  400 CONTINUE                                                           NEXTCR
      N1=I1                                                              NEXTCR
      N2=I2                                                              NEXTCR
C     CALCULATION OF EXTRA GROUND ATTENUATION AND GROUND REFLECTION      NEXTCR
```

```
      IF(IEGA.EQ.I1) N1=I2
      SK=F1
      DO 500 N=N1,N2
      DO 500 I=I1,NOBS
      DO 475 J=I1,I17
      IF  (N-1)  440, 440, 442
440   CALL EGACAL(PD(I,J),B2(I,J),NCF,BCF,TGAGR)
      GO TO 448
442   SK=FM1
      IF(IGDR.EQ.IO)GO TO 446
      DO 444 K1=1,NCF
444   TGAGR(K1)=F3
      GO TO 448
446   CALL GRDRFX(BCF,      NCF,IO,PD(I,J),CPNC(I,J),B1(I,J),CA,XKN,ND,
     * FLD,ZNR,ZNI,TGAGR)
448   CONTINUE
      DO 450 K=1,NCF
      SPLT(K,J)=TGAGR(K)
450   TSPL(K,I,J)=TSPL(K,I,J)+TGAGR(K)* SK
475   CONTINUE
      IF(IPRT(5).NE.5)GO TO 500
      DO 498 K=I1,NCF
      IK=1
      IF(LCT.GE.54) GO TO 460
      IF(K.EQ.1.AND.LCT.LE.48) GO TC 493
      IF(K.EQ.1) GO TO 460
      GO TO 490
460   CALL PRINTH(IPRT(I),LCT,9)
      WRITE(9,20)
      LCT=11
      IF  (N-1)  470, 470, 474
470   WRITE(9,480)SLDISX(I),XL(IUNIT+1)
480   FORMAT(2X,32HEXTRA-GROUND-ATTENUATION FOR X =,1PE10.3,1X,A2)
      LCT=LCT .
482   WRITE(9,382)
      LCT=LCT+4
490   WRITE(9,250) PFREQ(K),(SPLT(K,J),J=I1,I17)
      LCT=LCT+1
491   IF(K.NE.NCF)GO TO 498
      IF(LCT.GT.49)GO TO 495
      IK=2
492   WRITE(9,275)(ETA(J),J=I1,I17)
      IF  (IK-1)  493, 493, 498
 493  CONTINUE
      IF  (N-1)  470, 470, 474
474   WRITE(9,477)SLDISX(I),XL(IUNIT+1)
477   FORMAT(2X,17HGROUND REFLECTION,8X, 7HFOR X =,1PE10.3,1X,A2 )
      LCT=LCT+1
      IF(IGDR.EQ.IO)GO TO 482
      IF(K.NE.1)GO TO 491
476   FORMAT(/2X,47HGROUND REFLECTION = -3 DB ATTENUATION OR +3 DB ,
     *      29HCORRECTION FOR ALL PASSBANDS./ )
      WRITE(9,476)
      LCT=LCT+3
      GO TO 500
495   CALL PRINTH(IPRT(5),LCT,9)
      LCT=LCT+5
```

```
      WRITE(9,20)
      LCT=LCT+3
      IK=2
      IF  (N-1)  496, 496, 497
496   WRITE(9,480)SLDISX(I),XL(IUNIT+1)
      LCT=LCT+1
      GO TO 492
497   WRITE(9,477)SLDISX(I),XL(IUNIT+1)
      LCT=LCT+1
      GO TO 492
498   CONTINUE
500   CONTINUE
      ENDFILE 9
      REWIND 9
      RETURN
      END
```

```
      SUBROUTINE NINPUT
C
C     INPUT DATA BLOCKS FOR NOISE COMPONENTS
C     ITYPE DEFINES THE TYPE OF NOISE COMPONENT
C ITYPE=1  PRIMARY JET
C  =2      PRIMARY AND SECONDARY JET
      COMMON/JETDAT/NJET1,MCODE1,AP1,WF1,VP1,AS2,WS2,VS2,PR1,PA1,
     1     TT1,VA1,DIAMT1,ANGJT1,ICOR1
C  =3      CORE AND TURBINE
      COMMON/COREIN/TT3,PP3,CMF3,EK3,DELT3,JB3,
     *  ICOR3,LIN3,NTF3,IMA3,LGM3,NWL3,IDP3,ILAY3,TF3(10),
     *  PCTA3(10),PLA3(10),ELOH3,EDH3,R1W3(10),TL3(10),CF3,FM3
C
      COMMON/TURBIN/BN3,SS3,VTR3,CLS3,DT3,TU3,FMF3,CS3,IC3,ISW3
C  =4      COMPRESSOR AND INLET FAN
C  =5      EXIT FAN
      COMMON/FANDAT/NSTG45,NLET45,NAFT45,IDP45,NB45(3),FPR45(3),
     1  DIAM4(3),RSS45(3),AREA5(3),RN145,RTS45,CFPR4,DELT45,
     *  NI5,BPR5,ICOR4,LIN4,NTF4,IMA4,LGM4,NWL4,IDP4,ILAY4,TF4(10),
     *  PCTA4(10),PLA4(10),ELOH4,EDH4,R1W4(10),TL4(10),CF4,FM4,
     *  ICOR5,LIN5,NTF5,IMA5,LGM5,NWL5,IDP5,ILAY5,TF5(10),
     *  PCTA5(10),PLA5(10),ELOH5,EDH5,R1W5(10),TL5(10),CF5,FM5
C  =6      AUGMENTER-WING JET
      COMMON/SWITCH/NTYPE,ITYPE,NENG,IDCP,IPRT(7),ICN(13),NLCPT
     *,INSEOW(3),INSHLD
      COMMON/AUGWNG/GAMA6,TT6,XNPR6,DELT6,AD6,CE6,
     *  ICOR6,LIN6,NTF6,IMA6,LGM6,NWL6,IDP6,ILAY6,TF6(10),
     *  PCTA6(10),PLA6(10),ELOH6,EDH6,R1W6(10),TL6(10),CF6,FM6
C  =7      BLOWN-FLAP JET
      COMMON/BLOWIN/PR7,TT7,AN7,DN7,FANG7,DELT7,CL7,HD7,ICOR7
      DIMENSION PR7(1)
C  =8       LIFT-FAN
      COMMON/LFTFAN/NB8,FPR8,DIAM8,RSS8,AREA8,RN18,RTS8,CRFPR8,DELTA8,
     *  ICOR8,LIN8,NTF8,IMA8,LGM8,NWL8,IDP8,ILAY8,TF8(10),PCTA8(10),
     *  PLA8(10),ELOH8,EDH8,R1W8(10),TL8(10),CF8,FM8
C  =9      EJECTOR - SUPPRESSOR JET
      COMMON /EJECTO/ IEJ9,NUM9,AREA9,AR9,ST9,EXNM9,SMACH9,CV9,
     *  PS9,PA9,PTS9,EMACH9,PCV9,DELT9,
     *  ICOR9,LIN9,NTF9,IMA9,LGM9,NWL9,IDP9,ILAY9,TF9(10),PCTA9(10),
     *  PLA9(10),ELOH9,EDH9,R1W9(10),TL9(10),CF9,FM9
C  =10     PROPELLER
      COMMON/PROPIN/T10,W10,RPM10,D10,CSUB10,ASUB10,B10,DELT10,
     *ICOR10
C  =11     HELICOPTER AND TILT ROTOR
      COMMON/COPTER/T11,Q11,RPM11,B11,DT11,AB11,DE11,RN11,
     1       SI11,CEE11,DELT11,XLMC11,XMM11,NRTR11,LLF11,IRR11,
     *ICOR11
C
C  =12     MEASURED DATA INPUTS
      COMMON/MEASIN/NEP12,NPSI12,NBTA12,DELT12,EP12(5),PSI12(17),
     *   BETA12(5),
     *ICOR12
C
C     ITYPE = 13  JET EDGE INTERACTION
      COMMON/JETEDG/AJS13,DDA13,DDNE13,CHNL13,CJCL13,
     *FLAP13,HD13,EMJ13,TSR13,ICOR13
C
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C      THIS ROUTINE HANDLES LINKAGE TO INPUT MODULES  FLIGHT-PATH
C      OBSERVER GEOMETRY MODULE  VARIOUS NOISE ESTIMATION MODULES
C      EXTRAPOLATION MODULE  HUMAN RESPONSE MEASUREMENT MODULE
C
C      CONSTANTS USED IN INTERNAL CALCULATIONS
C
       COMMON /GCONST/ IN,IO,IT1,IT2,FO,F1,F2,F3,F4,F5,F6,F7,F8,F9,F10,
      *                I0,I1,I2,I3,I4,I5,I6,I7,I8,I9,I10,P1,P33,P5,P001,
      *                EPS,UNDEF,BL,ICD,DFR,RPD,ETA(17),M1,FM1,I17,A,PI
C
C      VARIABLE SET CALCULATED IN THE PROGRAM PROCESSING
C
       COMMON /GCOMON/ NCF,NK,BCF(24),ISPL(24,10,17),SPLT(24,17),
      *BUF(25),RETA(17),SPL2(17),TGAGR(24),DCPSF(17)
C
C      FREQUENCY BANDS USED BY PROGRAM
C
       COMMON /GFREQ/ CFREQ(24),UFREQ(25),PFREQ(24)
C
C      GENERAL INPUT PARAMETERS
C
       COMMON /GPRAM/ALTP,ALTR,SLOPE,AMACH,NOBS,SLDIST(10),NTENG,IUNIT
      *    ,ISPTRM,IATMOS,IAIR,UAIRAB(24),NTEMP,TEMP(50),TALT(50)
      *    ,NPRES,PRES(50),PALT(50),NHUMID,RALT(50),RHUMID(50),CTEMP
      *    ,CPRES,CRHUMD,IEGA,IGDR,DTEMP,DPRES,DHUMID,XKN,NC,FLD(50),
      * ZNR(50),ZNI(50),LINECT,MAXLIN,IPAGE,BCG,TCG,FLR,AALT,EPF
C
C      AIRCRAFT-OBSERVER GEOMETRY OUTPUTS
C
       COMMON /GEOMO/ APY(10,17),APZ(10,17),PD(10,17),DPND(10,17),
      * B1(10,17),B2(10,17),TDS(17,10),TPD(17,10),IRR(10,17)
      *,APP,TP,RHP,APO,TO,RHO,CA,CZ,TSP(17,10),CCV
C
C      CONVERSION CONSTANTS
C
       COMMON/GCONVC/C(2,10),SLDISX(10)
       COMMON/CRSPLS/DDB(17),PSCR(17),DFB(408),NPSCR
       COMMON/ICPATH/NCAS,NCCF,NTYP,IC,NRN,IARRAY(2)
C
C
       COMMON/HEAD/HIN(20),HOUT(20),CHIN(20)
C
C         THIS SECTION IS FOR STORING DATA LOCALLY
       DIMENSION INB5(3),XBP5(3),INUM(3),AREA9(1),IEJ(3)
       DIMENSION ICOR3(1),IADD3(8,3),ADD3(54,3),ICOR4(1),IADD4(8,3),
      1  ADD4(54,3),ICOR5(1),IADD5(8,3),ADD5(54,3),ICOR6(1),IADD6(8,3),
      2  ADD6(54,3),ICOR7(1),ICOR8(1),IADD8(8,3),
      3  ADD8(54,3),ICOR9(1),IADD9(8,3),ADD9(54,3)
       DIMENSION FPR8(1),INB8(3)
C
       DIMENSION ICON(20),EDGVAR(10)
       DIMENSION S1(9,3),S2(3,3),S3(13,3),S45(14,3),S6(6,3),S7(8,3),
      1          S8(8,3),S9(12,3),S10(8,3),S11(13,3),S12(3)
      2,S13(10,3),IADD13(3)
       DIMENSION NC(4,3),IS45(7,3),JET1(2,3)
       DIMENSION NDIC(4)
       EQUIVALENCE (NTYPE,NDIC(1))
```

```
      DIMENSION T3(5),J3(3,3)                                           NINPUT
      EQUIVALENCE (T3(1),TT3)                                           NINPUT
      DIMENSION B3(8)                                                   NINPUT
      EQUIVALENCE (B3(1),BN3)                                           NINPUT
      DIMENSION T113(13),I113(3,3)                                      NINPUT
      EQUIVALENCE (T113(1),T11)                                         NINPUT
      DIMENSION AUGI(6)                                                 NINPUT
      EQUIVALENCE (GAMA6,AUGI(1))                                       NINPUT
      DIMENSION PROPI(8)                                                NINPUT
      EQUIVALENCE (T10,PROPI(1))                                        NINPUT
      DIMENSION IJET(2),AJET(12)                                        NINPUT
      EQUIVALENCE (IJET(1),NJET1),(AJET(1),AP1)                         NINPUT
      DIMENSION IFAN1(7),FAN2(3),FANI1(3),FAN3(3),FANA1(3),FAN5(20)     NINPUT
      EQUIVALENCE (IFAN1(1),NSTG45),(FAN2(1),FPR45(1)),(FANI1(1),       NINPUT
     1   DIAM4(1)),(FAN3(1),RSS45(1)),(AREA5(1),FANA1(1)),(FAN4,RN145), NINPUT
     2   (FANI2,RTS45)                                                  NINPUT
      EQUIVALENCE (ICOR1,ICOR2)                                         NINPUT
      NAMELIST/NOISIN/T10,W10,RPM10,D10,DSUB10,ASUB10,B10,DELT10,NRTR11, NINPUT
     *  NENG,NTYPE,ITYPE,GAMA6,TT6,XNPR6,DELT6,AD6,DE6,LLF11,IEJ9,NUM9,  NINPUT
     *  NSTG45,NLET45,NAFT45,FPR45,DIAM4,RSS45,AREA5,RN145,AREA9,AR9,    NINPUT
     *  RTS45,CFPR4,DELT45,NB45,NI5,BPR5,NJET1,MCODE1,AP1,WP1,VP1,ST9,   NINPUT
     *  AS2,WS2,VS2,PR1,PA1,TT1,DIAMT1,ANGJT1,BN3,SS3,VTR3,CLS3,EXNM9,   NINPUT
     *  DT3,TU3,PMF3,CS3,IC3,ISW3,TT3,PP3,CMF3,EK3,DELT3,JB3,T11,SMACH9, NINPUT
     *  Q11,RPM11,B11,DT11,AB11,DE11,RN11,SI11,CEE11,DELT11,XLMC11,CV9,  NINPUT
     *  NEP12,NPSI12,NBTA12,DELT12,EP12,PSI12,BETA12,DCB,PSCR,DPB,NPSCR, NINPUT
     *  ICOR3,LIN3,NTF3,IMA3,LGM3,NWL3,IDP3,ILAY3,TF3,PCTA3,PLA3,EMACH9, NINPUT
     *  ELOH3,EDH3,R1W3,TL3,CF3,FM3,ICOR4,LIN4,NTF4,IMA4,LGM4,NWL4,PS9,  NINPUT
     *  IDP4,ILAY4,TF4,PCTA4,PLA4,ELOH4,EDH4,R1W4,TL4,CF4,FM4,ICOR5,PA9, NINPUT
     *  LIN5,NTF5,IMA5,LGM5,NWL5,IDP5,ILAY5,TF5,PCTA5,PLA5,ELOH5,EDH5,   NINPUT
     *  R1W5,TL5,CF5,FM5,ICOR6,LIN6,NTF6,IMA6,LGM6,NWL6,IDP6,ILAY6,TF6,  NINPUT
     *  PCTA6,PLA6,ELOH6,EDH6,R1W6,TL6,CF6,FM6,ICOR7,NB8,FPR8,DIAM8,     NINPUT
     *  RSS8,AREA8,RN18,RTS8,CRFPR8,DELTA8,PR7,TT7,AN7,DN7,FANG7,DELT7,  NINPUT
     *  ICOR8,LIN8,NTF8,IMA8,LGM8,NWL8,IDP8,ILAY8,TF8,PCTA8,PLA8,DELT9,  NINPUT
     *  ELOH8,EDH8,R1W8,TL8,CF8,FM8,ICOR9,LIN9,NTF9,IMA9,LGM9,NWL9,PTS9, NINPUT
     *  IDP9,ILAY9,TF9,PCTA9,PLA9,ELOH9,EDH9,R1W9,TL9,CF9,FM9,PCV9,      NINPUT
     *ICOR10,ICOR11,ICOR12,ICOR1,ICOR2,XMM11,DL7,HC7,IRR11,EDGVAR,INSHLD NINPUT
     *,ICOR13                                                           NINPUT
C                                                                       NINPUT
      IF(NTYP.NE.IO)GO TO 1015                                          NINPUT
 1000 READ(IN,9000)FAN5                                                 NINPUT
C                                                                       NINPUT
      IF(NCAS.EQ.I1)GO TO 1011                                          NINPUT
      IF(FAN5(1).EQ.BL.AND.FAN5(2).EQ.BL.AND.FAN5(3).EQ.BL.             NINPUT
     1  AND.FAN5(4).EQ.BL.AND.FAN5(5).EQ.BL.AND.FAN5(6).EQ.BL.          NINPUT
     2  AND.FAN5(7).EQ.BL.AND.FAN5(8).EQ.BL)GO TO 1015                  NINPUT
 1011 DO 1012 I=1,20                                                    NINPUT
 1012 CHIN(I)=FAN5(I)                                                   NINPUT
C                                                                       NINPUT
      IF(NCAS.NE.I1.OR.NTYP.NE.IO)GO TO 1015                            NINPUT
C     STORE DEFAULT VALUES FOR ITYPE=13                                 NINPUT
      EDGVAR( 1)=DONE13                                                 NINPUT
      EDGVAR( 2)=EMJ13                                                  NINPUT
      EDGVAR( 3)=HD13                                                   NINPUT
      EDGVAR( 4)=TSR13                                                  NINPUT
      EDGVAR(5)=SHAM                                                    NINPUT
      EDGVAR( 6)=AJS13                                                  NINPUT
      EDGVAR( 7)=DDA13                                                  NINPUT
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      EDGVAR( 8)=DHNL13                                                 NINPUT
      EDGVAR( 9)=DJCL13                                                 NINPUT
      EDGVAR(10)=FLAP13                                                 NINPUT
 1015 NTYP=NTYP+I1                                                      NINPUT
      IF(NCAS.EQ.I1) GO TO  1330                                        NINPUT
      IGO=ICON(IC)                                                      NINPUT
      GO TO( 1017,1060,1080,1100,1120,1200,1220,1230,1240,1250,1270,1290 NINPUT
     1,1293),IGO                                                        NINPUT
 1017 CONTINUE                                                          NINPUT
      DO 1018 I=I1,I3                                                   NINPUT
 1018 AJET(I+3)=0.                                                      NINPUT
 1020 CONTINUE                                                          NINPUT
      DO  1030  I=I1,I3                                                 NINPUT
 1030 AJET(I)=S1(I,NCOF)                                                NINPUT
      DO  1040  I=I4,I9                                                 NINPUT
 1040 AJET(I+3)=S1(I,NCOF)                                              NINPUT
      DO  1050  I=I1,I2                                                 NINPUT
 1050 IJET(I)=JET1(I,NCOF)                                              NINPUT
      GO TO  1300                                                       NINPUT
C                                                                       NINPUT
 1060 CONTINUE                                                          NINPUT
      DO  1070  I=I1,I3                                                 NINPUT
 1070 AJET(I+3)=S2(I,NCOF)                                              NINPUT
      GO TO  1020                                                       NINPUT
 1080 CONTINUE                                                          NINPUT
      CALL  SN(ICOR3,IADD3(1,NCOF),2,8,1)                               NINPUT
      CALL  SN(TF3,ADD3(1,NCOF),1,54,1)                                 NINPUT
      DO  1090  I=I1,I5                                                 NINPUT
 1090 T3(I)=S3(I,NCOF)                                                  NINPUT
      JB3=J3(1,NCOF)                                                    NINPUT
      DO 1105  I=I6,13                                                  NINPUT
 1105 B3(I-5)=S3(I,NCOF)                                                NINPUT
      IC3=J3(2,NCOF)                                                    NINPUT
      ISW3=J3(3,NCOF)                                                   NINPUT
      GO TO  1300                                                       NINPUT
 1100 CONTINUE                                                          NINPUT
      CALL  SN(ICOR4,IADD4(1,NCOF),2,8,1)                               NINPUT
      CALL  SN(TF4,ADD4(1,NCOF),1,54,1)                                 NINPUT
      DO  1110  I=I4,I6                                                 NINPUT
 1110 FAN11(I-3)=S45(I,NCOF)                                            NINPUT
      CFPR4=S45(15,NCOF)                                                NINPUT
      GO TO  1140                                                       NINPUT
 1120 DO  1130  I=I10,12                                                NINPUT
 1130 FANA1(I-9)=S45(I,NCOF)                                            NINPUT
      NI5=INI5(NCOF)                                                    NINPUT
      BPR5=XBP5(NCOF)                                                   NINPUT
      CALL  SN(ICOR5,IADD5(1,NCOF),2,8,1)                               NINPUT
      CALL  SN(TF5,ADD5(1,NCOF),1,54,1)                                 NINPUT
 1140 DO  1150  I=I1,I2                                                 NINPUT
 1150 IFAN1(I)=IS45(I,NCOF)                                             NINPUT
      DO  1160  I=I5,I7                                                 NINPUT
 1160 IFAN1(I)=IS45(I,NCOF)                                             NINPUT
      DO  1170  I=I1,I3                                                 NINPUT
 1170 FAN2(I)=S45(I,NCOF)                                               NINPUT
      DO  1180  I=I7,I9                                                 NINPUT
 1180 FAN3(I-6)=S45(I,NCOF)                                             NINPUT
      FAN4=S45(13,NCOF)                                                 NINPUT
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      FANI2=S45(14,NCOF)
      DELT45=S45(16,NCOF)
      GO TO  1300
 1200 DO  1210  I=I1,I6
 1210 AUGI(I)=S6(I,NCOF)
      CALL SN(ICOR6,IADD6(1,NCOF),2,8,1)
      CALL SN(TF6,ADD6(1,NCOF),1,54,1)
      GO TO  1300
 1220 CONTINUE
      CALL  N(PR7,S7(1,NCOF),1,8,1)
      GO TO 1300
 1230 CONTINUE
      NB8=INB8(NCOF)
      CALL SN(FPR8, S8(1,NCOF), 1, 8, 1)
      CALL SN(ICOR8,IADD8(1,NCOF),2,8,1)
      CALL SN(TF8,ADD8(1,NCOF),1,54,1)
      GO TO 1300
 1240 CONTINUE
      NUM9=INUM(NCOF)
      IEJ9=IEJ(NCOF)
      CALL SN(AREA9,S9(1,NCOF),1,12,1)
      CALL SN(ICOR9,IADD9(1,NCOF),2,8,1)
      CALL SN(TF9,ADD9(1,NCOF),1,54,1)
      GO TO 1300
 1250 CONTINUE
      DO  1260  I=I1,I8
 1260 PROPI(I)=S10(I,NCOF)
      GO TO  1300
 1270 CONTINUE
      DO  1280  I=I1,I3
 1280 I113(I)=S11(I,NCOF)
      NRTR11=I113(1,NCOF)
      LLF11=I113(2,NCOF)
      IRR11=I113(3,NCOF)
      GO TO  1300
 1290 DELT12=S12(NCOF)
      GO TO  1300
 1293 CONTINUE
      DO 1295 I=I1,I10
 1295 EDGVAR(I)=S13(I,NCOF)
      ICOR13=IADD13(NCOF)
 1300 IF(NTYP.NE.I1)GO TO  1320
      DO 1310 I=I1,I3
 1310 NDIC(I)=NC(I,NCOF)
      INSHLD=NC(4,NCOF)
 1320 ITYPE=IGO
 1330 READ(IN,NOISIN)
C
      IF(NCAS.EQ.I1) ICON(IC)=ITYPE
      GO TO( 1335,1380,1400,1420,1440,1520,1540,1550,1560,1570,1590,1610
     1,1650),ITYPE
 1335 CONTINUE
      DO 1336 I=I1,I3
 1336 AJET(I+3)=0.
 1340 CONTINUE
      DO  1350  I=I1,I3
 1350 S1(I,NCOF)=AJET(I)
```

```
      DO  1360  I=I4,I9
 1360 S1(I,NCOF)=AJET(I+3)
      DO  1370  I=I1,I2
 1370 JET1(I,NCOF)=IJET(I)
      GO TO  1620
 1380 CONTINUE
      DO  1390  I=I1,I3
 1390 S2(I,NCOF)=AJET(I+3)
      GO TO  1340
 1400 CONTINUE
      CALL  SN(ICOR3,IADD3(1,NCOF),2,8,2)
      CALL  SN(TF3,ADD3(1,NCOF),1,54,2)
      DO  1410  I=I1,I5
 1410 S3(I,NCOF)=T3(I)
      J3(1,NCOF)=JB3
      DO 1415 I=I6,I3
 1415 S3(I,NCOF)=B3(I-5)
      J3(2,NCOF)=IC3
      J3(3,NCOF)=ISW3
      GO TO  1620
 1420 CONTINUE
      DO  1430  I=I4,I6
 1430 S45(I,NCOF)=FANI1(I-3)
      S45(15,NCOF)=CFPR4
      CALL  SN(ICOR4,IADD4(1,NCOF),2,8,2)
      CALL  SN(TF4,ADD4(1,NCOF),1,54,2)
      GO TO  1460
 1440 CONTINUE
      INI5(NCOF)=NI5
      XBP5(NCOF)=BPR5
      CALL  SN(ICOR5,IADD5(1,NCOF),2,8,2)
      CALL  SN(TF5,ADD5(1,NCOF),1,54,2)
      DO  1450  I=I10,I2
 1450 S45(I,NCOF)=FANA1(I-9)
 1460 DO  1470  I=I1,I2
 1470 IS45(I,NCOF)=IFAN1(I)
      DO  1480  I=I5,I7
 1480 IS45(I,NCOF)=IFAN1(I)
      DO  1490  I=I1,I3
 1490 S45(I,NCOF)=FAN2(I)
      DO  1500  I=I7,I9
 1500 S45(I,NCOF)=FAN3(I-6)
      S45(13,NCOF)=FAN4
      S45(14,NCOF)=FANI2
      S45(16,NCOF)=DELT45
      GO TO  1620
 1520 CONTINUE
      CALL  SN(ICOR6,IADD6(1,NCOF),2,8,2)
      CALL  SN(TF6,ADD6(1,NCOF),1,54,2)
      DO  1530  I=I1,I6
 1530 S6(I,NCOF)=ALGI(I)
      GO TO  1620
 1540 CONTINUE
      CALL  SN(PR7,S7(1,NCOF),1,8,2)
      GO TO 1620
 1550 CONTINUE
      INB8(NCOF)=NB8
```

```
      CALL SN(FPR8, S8(1,NCOF), 1, 8, 2)
      CALL SN(ICOR8,IADD8(1,NCOF),2,8,2)
      CALL SN(TF8,ADD8(1,NCOF),1,54,2)
      GO TO 1620
 1560 CONTINUE
      INUM(NCOF)=NUM9
      IEJ(NCOF)=IEJ9
      CALL SN(AREA9,S9(1,NCOF),1,12,2)
      CALL SN(ICOR9,IADD9(1,NCOF),2,8,2)
      CALL SN(TF9,ADD9(1,NCOF),1,54,2)
      GO TO 1620
 1570 CONTINUE
      DO   1580  I=I1,I8
 1580 S10(I,NCOF)=PROPI(I)
      GO TO  1620
 1590 CONTINUE
      DO   1600  I=I1,I3
 1600 S11(I,NCOF)=T113(I)
      I113(1,NCOF)=NRTR11
      I113(2,NCOF)=LLF11
      I113(3,NCOF)=IRR11
      GO TO  1620
 1610 S12(NCOF)=DELT12
 1620 IF(NTYP.NE.I1)GO TO  1640
      DO 1630 I=I1,I3
 1630 NC(I,NCOF)=NDIC(I)
      NC(4,NCOF)=INSHLD
 1640 CONTINUE
C
 9000 FORMAT(20A4)
      IF(IUNIT.GT.0)GO TO 1700
      CALL CONVR(ITYPE,I1,I1)
C
 1700 RETURN
 1650 CONTINUE
C     STORE JET EDGE INTERACTION CURRENT DATA
      DO 1660 I=I1,I10
 1660 S13(I,NCOF)=EDGVAR(I)
      IADD13(NCOF)=ICOR13
      DCNE13 = EDGVAR( 1)
      EMJ13  = EDGVAR( 2)
      HC13   = EDGVAR( 3)
      TSR13  = EDGVAR( 4)
      SHAM   = EDGVAR( 5)
      AJS13  = EDGVAR( 6)
      DDA13  = EDGVAR( 7)
      DHNL13 = EDGVAR( 8)
      DJCL13 = EDGVAR( 9)
      FLAP13 = EDGVAR(10)
      GO TO 1620
      END
```

```
      SUBROUTINE NOISO(IPRT, I   ,NK,ICLT,CHIN,IUNIT,X,CFREC,SP,NCF
     * ,ITYPE)
      COMMON/ISWK/ISWT(3,13)
      COMMON/SWITCH/NTYPE,IDUMT,NENG,ICCF,IDUM(7),ICN(13),NLCPT
     *,INSECW(3),INSHLD
      COMMON/TURBIN/XXXXXX(9),ISW3
      COMMON/ICPATH/NCAS,NCCF,NTYP,IC,NRN,IARRAY(2)
      COMMON/IMSPL/SPZ(24,17),IB(2,3,13)
      COMMON/CLABEL/CH(2,8)
      COMMON/ANGLE/PSI(17,10),PSIC(17,10),BETA(17,10)
      COMMON/SDELT/DT
      COMMON /GCONST/ IN,IO,IT1,IT2,F0,F1,F2,F3,F4,F5,F6,F7,F8,F9,F10,
     *                I0,I1,I2,I3,I4,I5,I6,I7,I8,I9,I10,P1,P33,P5,P001,
     *                EPS,UNDEF,BL,ICD,CPR,RPC,ETA(17),M1,FM1,I17,A,PI
      DIMENSION TIT(8,14),CHIN(20),CFREC(24),SP(24,17)
      DIMENSION TNU(4,2)
      DATA TNU/4HCORE,4H NOI,4HSE   ,4H     ,
     *4HTURB,4HINE ,4HNOIS,4HE    /
      DATA TIT/4HPRIM,4HARY ,4HJET ,4HNOIS,1HE,3*1H ,
     2   4HPRIM,4HARY ,4HAND ,4HSECC,4HNDAR,4HY JE,4HT NO,4HISE ,
     3   4HCORE,4H AND,4H TUR,4HBINE,4H NOI,2HSE,2*1H ,
     4   4HCOMP,4HRESS,4HOR A,4HND I,4HNLET,4H FAN,4H NOI,2HSE,
     5   4HEXIT,4H FAN,4H NOI,2HSE,4*1H ,
     6   4HAUGM,4HENTE,4HR-WI,4HNG J,4HET N,4HOISE,2*1H ,
     7   4HBLOW,4HN-FL,4HAP J,4HET N,4HOISE,3*1H ,
     9   4HLIFT,4H-FAN,4H NOI,2HSE,4*1H ,
     8   4HEJEC,4HTOR-,4HSUPP,4HRESS,4HOR J,4HET N,4HOISE,1H ,
     X   4HPROP,4HELLE,4HR NO,3HISE,4*1H ,
     Y   4HHELI,4HCOPT,4HER N,4HOISE,4*1H ,
     Z   4HMEAS,4HURED,4H DAT,4HA NC,3HISE,3*1H ,
     U4HJET ,4HEDGE,4H INT,4HERAC,4HTION,3*1H ,
     W4HTOTA,4HL NO,4HISE ,4H(ALL,4H CCM,4HPONE,4HNTS),2H  /
      DATA DT/2000./
      ISW=1
      IF(IPRT.EQ.0)RETURN
C     WRITE(IOUT,5)ISWT(NCOF,IDUMT)
    5 FORMAT(1X,5HISWT=,I10)
      ITTT=ISWT(NCOF,IDUMT)
   90 CONTINUE
      IF(IPRT.NE.8)GO TO 95
   92 CONTINUE
      IF(LCT.LT.44) GO TO 95
      GO TO 100
   95 IF(NK.EQ.3.AND.IPRT.NE.8)GO TO 100
      IF(ISW.EQ.2)GO TO 115
      IF(I/2*2 .EQ.I) GO TO 115
  100 CALL PRINTH(IPRT,LCT,ICLT)
  104 IF(ITYPE.NE.3)WRITE(IOUT,105)(TIT(K,ITYPE),K=1,8)
      IF(ITYPE.EQ.3.AND.ISW3.EQ.0)WRITE(ICLT,105)(TIT(K,ITYPE),K=1,8)
      IF(ITYPE.EQ.3.AND.ISW3.EQ.2)WRITE(ICLT,106)(TNU(K,1),K=1,4)
      IF(ITYPE.EQ.3.AND.ISW3.EQ.3)WRITE(ICLT,106)(TNU(K,2),K=1,4)
  106 FORMAT(52X,4A4)
  105 FORMAT(52X,8A4)
      LCT=LCT+1
      IF(IPRT.EQ.8)GO TO 140
  115 GO TO(120,120,120,120,120,154,150,104),IPRT
  150 CONTINUE
```

```
      IF  (ISW-1)  152, 152, 189                                        NOISO
  152 IF(ITTT.NE.0.OR.INSHLD.NE.0)ISW=2                                 NOISO
      IF(ITYPE.EQ.13)ISW=1                                              NOISO
C                                                                       NOISO
 154  WRITE(IOUT,155)                                                   NOISO
      LCT=LCT+3                                                         NOISO
 155  FORMAT(49X,35HINDEX, FREE-FIELD SPECTRA (R = 1 M)//)              NOISO
      CALL  PRTSH1(IUNIT,X,LCT,IOUT,2)                                  NOISO
      GO TO 125                                                         NOISO
 120  CALL  PRTSH1(IUNIT,X,LCT,IOUT,1)                                  NOISO
 125  WRITE(IOUT,130)(CFREQ(K1),(SP(K1,K2),K2=1,17),K1=1,NCF)           NOISO
 130  FORMAT(1X,1PE10.3,1X,0PF7.1,16F7.1)                               NOISO
      LCT=LCT+1                                                         NOISO
      GO TO(140,140,140,140,140,160,180),IPRT                           NOISO
 160  WRITE(IOUT,170)(ETA(J1),J1=1,17),X,CH(IUNIT+1,1)                  NOISO
 170  FORMAT(/2X,8HANGLE XI/3X,5H(DEG),3X,17F7.0//50X,                 NOISO
     *     19HSIDELINE DISTANCE =,1PE10.3,A3      /)                    NOISO
      LCT=LCT+6                                                         NOISO
      RETURN                                                            NOISO
 140  CALL  WRPNL(NK,I,IOUT,LCT,IPRT)                                   NOISO
 135  RETURN                                                            NOISO
 180  WRITE(IOUT,185)                                                   NOISO
 185  FORMAT(/3X,6HANGLES/3X,5H(DEG)/)                                  NOISO
      WRITE(IOUT,186)(PSI(J,I),J=1,17),(BETA(J,I),J=1,17),              NOISO
     *     (ETA(J),J=1,17)                                              NOISO
 186  FORMAT(4X,3HPSI,5X,17F7.1/4X,4HBETA,4X,17F7.1/                    NOISO
     *     4X,2HXI,6X,17F7.1)                                           NOISO
 200  CONTINUE                                                          NOISO
      DELT=DT*DPR                                                       NOISO
      WRITE(IOUT,187)DELT,X,CH(IUNIT+1,1)                               NOISO
 187  FORMAT(4X,5HDELTA,3X,F7.1,31X,20HSIDELINE DISTANCE =   ,          NOISO
     *     1PE10.3,A3/)                                                 NOISO
      LCT=LCT+9                                                         NOISO
      IF(ISW.EQ.2)GO TO 92                                              NOISO
      RETURN                                                            NOISO
  189 ISW=1                                                             NOISO
      ISWT(NCOF,IDUMY)=0                                                NOISO
      WRITE(IOUT,190)                                                   NOISO
 190  FORMAT(49X,35HPREDICTED CONFIGURATION CORRECTIONS  //)            NOISO
      LCT=LCT+3                                                         NOISO
      CALL  PRTSH1(IUNIT,X,LCT,IOUT,3)                                  NOISO
      WRITE(IOUT,130)(CFREQ(K1),(SPZ(K1,K2),K2=1,17),K1=1,NCF)          NOISO
      LCT=LCT+1                                                         NOISO
      WRITE(IOUT,185)                                                   NOISO
      WRITE(IOUT,195)(PSI(J,I),J=1,17),(ETA(J),J=1,17)                  NOISO
 195  FORMAT(4X,3HPSI,5X,17F7.1/4X,2HXI,6X,17F7.1)                      NOISO
      GO TO 200                                                         NOISO
      END                                                               NOISO
```

```
      SUBROUTINE NSRIO                                                  NSRIO
C                                                                       NSRIO
C     PURPOSE        TO READ NOISE SHIELDING REFRACTION                 NSRIO
C                    INPUT DATA AND SET UP CURVES FOR                   NSRIO
C                    DISCHARGE TURBOMACHINERY NOISE COMPONENTS          NSRIO
C                    DATA IS STORED FOR ALL COMPONENTS OF ALL THREE     NSRIO
C                    CONFIGURATIONS FOR THE FIRST CASE. THEN ONLY       NSRIO
C                    CHANGES IN DATA FOR A COMPONENT IN A CONFIGURATION NSRIO
C                    REPLACE DATA IN THE FIRST CASE                     NSRIO
C                                                                       NSRIO
C     INPUT                                                             NSRIO
C         EMJ        EXHAUST FLOW MACH NO                               NSRIO
C         IWED       AN ARRAY INDICATING THE TYPE OF WING EDGE          NSRIO
C                    DIFFRACTION SOLUTIONS TO BE INCLUDED FOR           NSRIO
C                    THE NOISE COMPONENT CONSIDERED                     NSRIO
C                    IWED(1)=1 TRAILING EDGE                            NSRIO
C                    IWED(2)=1 LEADING EDGE                             NSRIO
C                    IWED(3)=1 TIP EDGE                                 NSRIO
C         TSTSO      EXHAUST FLOW STATIC TEMPERATURE RATIO WITH         NSRIO
C                    TSO=TAMB IN ABSOLUTE UNITS(DEG R OR K)             NSRIO
C         ASF        ANGLE OFFSET, GAMMA, FOR ANGULAR SHIFT OF SOURCE.  NSRIO
C                    ONE-DIMENSIONAL ARRAYS FOR EMPIRICAL ADJUSTMENT    NSRIO
C         CPSIO      CURVES TO THEORETICAL JET REFRACTION MODEL WITH    NSRIO
C         FASS       CPSIO  =  COTANGENT(PSIO)  INDEPENDENT VARIABLE    NSRIO
C         BETA       FASS   =  ALFA IN FIGURE OF ENGR. DOC.             NSRIO
C                    BETA   =  BETA IN FIGURE OF ENGR. DOC.             NSRIO
C         NASRO      NUMBER OF POINTS IN THE EMPIRICAL CURVES-          NSRIO
C                    FASS VS. CPSIO AND BETA VS. CPSIO                  NSRIO
C                    IF NO INPUT CURVES ARE TO BE INPUT, SET NASRO = 0  NSRIO
C                    AND BUILT-IN CURVES WILL BE USED.                  NSRIO
C         USPL       EMPIRICAL DIRECTIVITY CURVE OF UNSHIELDED SPL      NSRIO
C         PSI        AT STATIC CONDITIONS USED IN SHIELDING CALCULATIONS NSRIO
C                    IF PREDICTED AND BUILT-IN VALUES ARE NOT DESIRED   NSRIO
C         NUSPL      NUMBER OF POINTS IN THE EMPIRICAL CURVE            NSRIO
C                    UPSL .VS. PSI                                      NSRIO
C         INUSP      INDICATOR TO DECIDE WHICH EMPIRICAL CURVE OF       NSRIO
C                    USPL .VS. PSI TO USE                               NSRIO
C                    INUSP=0      USE PREDICTED VALUES                  NSRIO
C                    INUSP=1      USE BUILT-IN VALUES                   NSRIO
C                    INUSP.GT.1  USE INPUT VALUES DEFINED ABOVE         NSRIO
C         DIAMT2     DIAMETER OF NOZZLE(M OR FT)SECONDARY JET           NSRIO
C         DSL1       DIMENSIONLESS SHIELD LENGTH TO NOZZLE EXIT PLANE   NSRIO
C         DSL2       PARALLEL TO EXHAUST AXIS (PRIMARY AND SECONDARY)   NSRIO
C                                                                       NSRIO
      COMMON /SWITCH/NTYPE,ITYPE                                        NSRIO
      COMMON/ICPATH/NCAS,NCOF,NTYP,IC                                   NSRIO
      COMMON /TURBIN/HM1,HM2,HM3,HM4,HM5,HM6,HM7,HM8,HM9,ISW3           NSRIO
      COMMON /GCONST/IN                                                 NSRIO
C         JET NOISE SHIELDING DATA                                      NSRIO
      COMMON/JNSHLD/DIAMT2,DSL1,DSL2                                    NSRIO
C     WING SHIELDING DATA                                               NSRIO
      COMMON/REFRAC/EMJ,TSTSO,IWED(3),FASS(24),BETA(24),CPSIO(24),NASRO, NSRIO
     * ASF,IWSFE                                                        NSRIO
      COMMON/UNSHLD/USPL(19),PSI(19),NUSPL,INUSP                        NSRIO
      DIMENSION FPSI(24),FBETA(24),TPSI(24),TBETA(24),CPSI(24),CBETA(24) NSRIO
     *,USPIN( 9),PSIIN( 9),USPAF(17),PSIAF(17),USPTB(17),PSITB(17),     NSRIO
     * USPCR(17),PSICR(17), FALF(24), TALF(24), CALF(24)                NSRIO
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C      STORAGE REQUIRED FOR SAVING DATA FOR NEXT CASE                    NSRIO
       DIMENSION ICON(20),ST01(3),ISTC1(3,3),STC2(3,3),IST32(3,3),       NSRIO
      * IS3C(3,3),IS3CC(3,3),ST3C(3,3),ST3CA(19,3),ST3CB(19,3),          NSRIO
      * ST3CC(10,3),ST3CD(10,3),IS3T(3,3),IS3TT(3,3),ST3T(3,3),          NSRIO
      *ST3TA(19,3),ST3TB(19,3),ST3TC(10,3),ST3TD(10,3),                  NSRIO
      *IS4(3,3),IS44(3,3),ST4A(19,3),ST4B(19,3),IS5(3,3),IS55(3,3),      NSRIO
      * ST5(3,3),ST5A(19,3),ST5B(19,3),ST5C(10,3),ST5D(10,3),            NSRIO
      * ST3CE(24,3),ST3TE(24,3),ST5E(24,3)                               NSRIO
       EQUIVALENCE (PSIAF(1),PSICR(1),PSITB(1)),(FPSI(1),TPSI(1),CPSI(1)) NSRIO
       NAMELIST/SHLDAT/EMJ,TSTSO,IWED,FASS,BETA,CPSIO,INASRO,ASF,        NSRIO
      *USPL,PSI,NUSPL,INUSP,DIAMT2,DSL1,DSL2                             NSRIO
C                                                                        NSRIO
C  DATA FOR EMPIRICAL ADJUSTMENT CURVES TO JET REFRACTION MODEL          NSRIO
       DATA INASRO /0/                                                   NSRIO
       DATA FPSI /-4.,-3.5,-3.,-2.75,-2.5,-2.25,-2.,-1.75,-1.5,-1.25,-1., NSRIO
     1 -.75,-.5,-.25, .25,.5,.75,1.,1.25,1.5,1.75,2.,2.5,3./             NSRIO
       DATA FALF /2*.45,.53,.64,.75,.87,1.02,1.22,1.42,1.55,1.47,1.3,1.16 NSRIO
      *,1.04,.93,.93,1.01,1.1,1.17,1.02,.88,.79,2*.75/                   NSRIO
       DATA CALF /2*.45,.51,.57,.67,.77,.86,.96,1.03,1.07,1.01,.9,.82,   NSRIO
      * .77,2*.75,.8,.91,.95,.92,.85,.78,2*.75/                          NSRIO
       DATA TALF /2*.45,.5,.53,.59,.67,.72,.78,.8,.72,.62,.55,.53,.54,   NSRIO
      * .56,.57,.61,.7,.79,.82,.8,.76,.75,.75/                           NSRIO
       DATA FBETA /2*.95,.92,.82,.63,.41,.18,-.07,-.28,-.4,-.37,-.19,.07, NSRIO
      * .37,.93,1.1,1.13,1.06,1.02,5*1./                                 NSRIO
       DATA CBETA /4*.95,.9,.8,.66,.48,.28,.07,-.07,.01,.27,.54,1.08,    NSRIO
      * 1.27,1.32,1.3,1.16,1.1,1.07,1.05,2*1./                           NSRIO
       DATA TBETA /2*.95,1.,1.07,1.17,1.2,1.17,1.04,.87,.6,.32,.26,.46,  NSRIO
      * .73,1.27,1.47,1.55,1.47,1.35,1.24,1.16,1.09,2*1./                NSRIO
C                                                                        NSRIO
C      UNSHIELDED DIRECTIVITY FOR HIGH-BYPASS RATIO TURBOFANS            NSRIO
       DATA USPIN/0.,0.,-1.,-3.,-6.,-11.,-17.5,-30.,-43./                NSRIO
       DATA PSIIN/0.,50.,60.,70.,80.,90.,100.,120.,140./                 NSRIO
       DATA USPAF/-27.,-21.5,-17.5,-14.5,-12.5,-11.,-9.,-7.,-4.,-1.5,0., NSRIO
      *-1.5,-5.5,-10.,-13.5,-16.,-17./                                   NSRIO
       DATA USPTB/-19.,-18.,-17.,-16.,-15.,-14.,-12.,-10.5,-7.,-2.5,0.,  NSRIO
      *-5.5,-11.,-13.5,-14.3,-14.5,-14.7/                                NSRIO
       DATA USPCR/-20.5,-17.5,-14.7,-13.3,-12.,-10.2,-8.5,-6.5,-4.,      NSRIO
      *-1.5,0.,-1.5,-4.,-7.5,-11.,-13.,-13.5/                            NSRIO
       DATA PSIAF/0.,20.,40.,50.,60.,70.,80.,90.,100.,110.,120.,130.,    NSRIO
      *140.,150.,160.,170.,180./                                         NSRIO
C                                                                        NSRIO
C      CHECK NOISE COMPONENT TYPE AND EXIT IF NOT INCLUDED               NSRIO
C                                                                        NSRIO
       IF(ITYPE.GT.5)GO TO 300                                           NSRIO
C                                                                        NSRIO
C      TEST IF FIRST CASE.IF IT IS READ DATA AND STORE FOR EACH          NSRIO
C      COMPONENT,IF NOT FIRST CASE RETRIEVE DATA FOR COMPONENT AND       NSRIO
C      CONFIGURATION AND THEN GO AND READ                                NSRIO
C                                                                        NSRIO
       IF(NCAS.NE.1)GO TO 400                                            NSRIO
       INUSP=0                                                           NSRIO
       INASRO=0                                                          NSRIO
       ASF  =  13.                                                       NSRIO
       EMJ=0.0                                                           NSRIO
       TSTSO=1.0                                                         NSRIO
       GO TO 600                                                         NSRIO
  400  IGO=ICON(IC)                                                      NSRIO
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```
      IF(IGO.GT.5)GO TO 300
      GO TO(410,420,430,440,450),IGO
C
C     PRIMARY JET
  410 DSL1=ST01(NCOF)
      DO 415 I=1,3
  415 IWED(I)=IST01(I,NCOF)
      GO TO 600
C
C     PRIMARY AND SECONDARY
  420 DSL2=ST02(1,NCOF)
      DIAMT2=ST02(2,NCOF)
      DSL1=ST02(3,NCOF)
      DO 425 I=1,3
  425 IWED(I)=IST02(I,NCOF)
      GO TO 600
C
C     TURBINE OR CORE
  430 IF(ISW3.NE.2)GO TO 435
C     CORE
      CALL WSDSTO(IGO   ,INASRC,IS3C(1,NCOF),IS3CC(1,NCOF),ST3CE(1,NCOF),
     *ST3C(1,NCOF),ST3CA(1,NCOF),ST3CB(1,NCOF),ST3CC(1,NCOF),
     * ST3CD(1,NCOF),2)
      GO TO 600
C
C     TURBINE
  435 CALL WSDSTO(IGO   ,INASRO,IS3T(1,NCOF),IS3TT(1,NCOF),ST3TE(1,NCOF),
     *ST3T(1,NCOF),ST3TA(1,NCOF),ST3TB(1,NCOF),ST3TC(1,NCOF),
     * ST3TD(1,NCOF),2)
      GO TO 600
C
C     INLET FAN
  440 CALL WSDSTO(IGO   ,INASRC,IS4(1,NCOF),IS44(1,NCOF),ST5E(1,NCOF),
     *ST5(1,NCOF),ST4A(1,NCOF),ST4B(1,NCOF),ST5C(1,NCOF),
     * ST5D(1,NCOF),2)
      GO TO 600
C
C     EXIT OR AFT FAN
  450 CALL WSDSTO(IGO   ,INASRC,IS5(1,NCOF),IS55(1,NCOF),ST5E(1,NCOF),
     *ST5(1,NCOF),ST5A(1,NCOF),ST5B(1,NCOF),ST5C(1,NCOF),
     * ST5D(1,NCOF),2)
C     READ NOISE COMPONENT SHIELDING DATA
C
  600 READ(IN,SHLDAT)
C     SAVE THE COMPONENT TYPE
      IF(NCAS.EQ.1)ICON(IC)=ITYPE
      GO TO(710,720,730,740,750),ITYPE
C
C     PRIMARY JET
  710 ST01(NCOF)=DSL1
      DO 715 I=1,3
  715 IST01(I,NCOF)=IWED(I)
      GO TO 300
C
C     PRIMARY AND SECONDARY JET
  720 ST02( 1,NCOF)=DSL2
      ST02(2,NCOF)=DIAMT2
```

```
      STO2(3,NCOF)=DSL1
      DO 725 I=1,3
  725 ISTO2(I,NCOF)=IWED(I)
      GO TO 300
C
C     TEST FOR CORE OR TURBINE
  730 IF(ISW3.NE.2)GO TO 735
C     CORE
      CALL WSDSTO(ITYPE,INASRO,IS3C(1,NCOF),IS3CC(1,NCOF),ST3CE(1,NCOF),
     *ST3C(1,NCOF),ST3CA(1,NCOF),ST3CB(1,NCOF),ST3CC(1,NCOF),
     * ST3CD(1,NCOF),1)
      GO TO 15
C     TURBINE
  735 CALL WSDSTO(ITYPE,INASRO,IS3T(1,NCOF),IS3TT(1,NCOF),ST3TE(1,NCOF),
     *ST3T(1,NCOF),ST3TA(1,NCOF),ST3TB(1,NCOF),ST3TC(1,NCOF),
     * ST3TD(1,NCOF),1)
      GO TO 15
C
C     INLET FAN
  740 CALL WSDSTO(ITYPE,INASRO,IS4(1,NCOF),IS44(1,NCOF),ST5E(1,NCOF),
     *ST5(1,NCOF),ST4A(1,NCOF),ST4B(1,NCOF),ST5C(1,NCOF),
     * ST5D(1,NCOF),1)
      GO TO 15
C
C     EXIT OR AFT FAN
  750 CALL WSDSTO(ITYPE,INASRO,IS5(1,NCOF),IS55(1,NCOF),ST5E(1,NCOF),
     *ST5(1,NCOF),ST5A(1,NCOF),ST5B(1,NCOF),ST5C(1,NCOF),
     * ST5D(1,NCOF),1)
C     IF PRIMARY AND SECONDARY RETURN
   15 CONTINUE
C
C     TEST UNSHIELDED EMPIRICAL DIRECTIVITY CURVE USAGE
C     BRANCH IF PREDICTED OR INPUT CURVE  TO BE USED
      IF(INUSP.NE.1)GO TO 100
C
C     STORE TEST DATA DIRECTIVITY CURVE FOR COMPONENT ITYPE
C     FROM BUILT-IN CURVES
      IF(ITYPE.NE.5)GO TO 30
      NUSPL=17
      DO 20 IS=1,NUSPL
      USPL(IS)=USPAF(IS)
   20 PSI(IS)=PSIAF(IS)
      GO TO 100
   30 IF(ITYPE.NE.4)GO TO 50
      NUSPL=9
      DO 40 IS=1,NUSPL
      USPL(IS)=USPIN(IS)
   40 PSI(IS)= PSIIN(IS)
      GO TO 100
   50 IF(ISW3.EQ.0)GO TO 280
      IF(ISW3.NE.3)GO TO 70
   55 NUSPL=17
      DO 60 IS=1,NUSPL
      USPL(IS)=USPTB(IS)
   60 PSI(IS)=PSITB(IS)
      GO TO 100
   70 NUSPL=17
```

```
      DO 80 IS=1,NUSPL                                                  NSRIO
      USPL(IS)=USPCR(IS)                                                NSRIO
   80 PSI(IS) =PSICR(IS)                                                NSRIO
C                                                                       NSRIO
C  CHECK FOR INPUT OF EMPIRICAL ADJUSTMENT CURVES FOR JET REFRACTION    NSRIO
C  MODEL, IF NOT INPUT, USE DEFAULT CURVES PER COMPONENT TYPE           NSRIO
  100 NASRO=INASRO                                                      NSRIO
      IF  (NASRO .NE. 0)  GO TO 300                                     NSRIO
      NASRO  = 24                                                       NSRIO
      IF(ITYPE.EQ.4)GO TO 300                                           NSRIO
      IF(ITYPE.NE.5)GO TO 130                                           NSRIO
      DO 120 IS=1,NASRO                                                 NSRIO
      BETA(IS) =FBETA(IS)                                               NSRIO
      FASS(IS)  =  FALF(IS)                                             NSRIO
  120 CPSIO(IS)=FPSI(IS)                                                NSRIO
      GO TO 300                                                         NSRIO
  130 IF(ISW3.NE.3) GO TO 150                                           NSRIO
      DO 140 IS=1,NASRO                                                 NSRIO
      BETA(IS) =TBETA(IS)                                               NSRIO
      FASS(IS)  =  TALF(IS)                                             NSRIO
  140 CPSIO(IS)=TPSI(IS)                                                NSRIO
      GO TO 300                                                         NSRIO
  150 DO 160 IS=1,NASRO                                                 NSRIO
      BETA(IS) =CBETA(IS)                                               NSRIO
      FASS(IS)  =  CALF(IS)                                             NSRIO
  160 CPSIO(IS)=CPSI(IS)                                                NSRIO
      GO TO 300                                                         NSRIO
  280 WRITE(6,290)                                                      NSRIO
  290 FORMAT(1H0,10X70HDO CORE SEPARATE FROM TURBINE WHEN SHIELDING INCL NSRIO
     $USED  TURBINE ASSUMED)                                            NSRIO
      GO TO 55                                                          NSRIO
  300 RETURN                                                            NSRIO
      END                                                               NSRIO
```

```
      SUBROUTINE PLOTIT(X,Y,SNDL,FPATH,NDIM,M2,M5)
C
C
C PURPOSE              INITIALIZE PLOTTER AND READ IN DATA
C
C INPUTS               MAXIMUM DIMENSION OF ARRAYS STORING FLIGHT PATH
C                      DATA POINTS
C
C OUTPUTS              PRINTED CONTOUR DATA POINTS
C                      PLOT OF NOISE LEVEL CONTOURS
C                      PLOT OF SIDLINE NOISE LEVEL
C
C
C  X,Y DIMENSIONS (NDIM) MUST BE AT LEAST 2 GREATER THAN THE NUMBER OF
C  FLIGHT PATH POINTS TO BE READ
C
      LOGICAL IWRITE
      DIMENSION X(NDIM,M2,M5),Y(NDIM,M2,M5),FPATH(NDIM,3),VNOISE(5),
     * AREA(5)
     * ,SNDL(NDIM,3),TITLE( 8),NDIST(3)
C 360
C    * ,SNDL(NDIM,3),TITLE(18),NDIST(3)
C
C 360
C     COMMON /PLT/ SCALV,YLENM,XLENM,CMPIN,LABELX(10),LABELY(10),
C    1 AXUNIT,NLABEL(2),SCALU,IWRITE
      COMMON /PLT/ SCALV,YLENM,XLENM,CMPIN,LABELX( 4),LABELY( 4),
     1 AXUNIT,NLABEL(1),SCALU,IWRITE
C
C  PLOTTING BUFFER MAY NOT BE REQUIRED FOR HOUSTON INSTRUMENT PLOTTER
C
      DIMENSION BUFFER(1024)
      DATA IBUF/1024/
C
      DATA CM,XIN /2HCM,2HIN/
      CMPIN=2.54001
      REWIND 2
      IWRITE= .FALSE.
C
C INITIALIZE PLOTTER TO WRITE ON TAPE99
      CALL PLOTS(BUFFER,IBUF,99)
C FACTOR REQUIRED ONLY FOR BCS 360 RUNS
C     CALL FACTOR(2.0)
C
C INPUT FROM CARDS GENERAL PLOTTING SPECS
C 360
C     READ(5,1000,END=905) SCALV,XLENM,YLENM,DUNITS,AXUNIT,NLABEL
      READ(5,1000)         SCALV,XLENM,YLENM,DUNITS,AXUNIT,NLABEL
      IF  (EOF(5))  905, 1905
 1905 CONTINUE
C 360
C1000 FORMAT(3F10.0,3X,A2,5X,A4,5X,2A4)
 1000 FORMAT(3F10.0,3X,A2,5X,A4,5X,A8)
C 360
C     READ(5,1001,END=905) LABELX,LABELY
      READ(5,1001        ) LABELX,LABELY
      IF  (EOF(5))  905, 2905
```

```
 2905 CONTINUE
C 360
C1001 FORMAT(10A4)
1001  FORMAT(4A10)
C
C LENGTH MUST BE IN CM UNITS
      IF(DUNITS.NE.XIN.AND.DUNITS.NE.CM)GO TO 901
      IF(DUNITS.EQ.CM)GO TO 20
      XLENM=XLENM*CMPIN
      YLENM=YLENM*CMPIN
C
 20   CONTINUE
C READ INITIALIZING DATA FROM TAPE2
C 360
C50   READ(2,2003,END=900) TITLE
C 360
C2003  FORMAT(18A4)
2003  FORMAT(8A10)
50    READ(2,2003) TITLE
      IF  (EOF(2))  900, 1903
1903  CONTINUE
C 360
C     READ(2,2000,END=902) NP,NL,NSD,NDIST
      READ(2,2000)         NP,NL,NSD,NDIST
      IF  (EOF(2))  902, 1902
 1902 CONTINUE
 2000 FORMAT(3I5,5X,A4,6X,A4,6X,A4)
      READ(2,2002)(VNOISE(I),I=1,NL)
2002  FORMAT(5E15.6,I5)
C
C  READ DATA FOR 1 SET OF PLOTS - CONTOUR + SIDELINE
C
      DO 100 I=1,NP
C 360
C     READ(2,2022,END=902) FPATH(I,1),FPATH(I,2),FPATH(I,3),
      READ(2,2022)         FPATH(I,1),FPATH(I,2),FPATH(I,3),
     X (SNDL(I,K),K=1,NSD)
 2022 FORMAT(6E15.6)
      IF  (EOF(2))  902, 1900
 1900 CONTINUE
C
C  READ DATA FOR EACH NOISE LEVEL AT POINT I
C
      DO 100 J=1,NL
      READ(2,2002)  X(I,1,J),X(I,2,J), Y(I,1,J),Y(I,2,J),AREA(J),IERR
100   CONTINUE
C
C  PLOT CONTOURS
C
      CALL FOTCNT(X,Y,VNOISE,FPATH,AREA,NP,NL,NDIM,TITLE)
C
C  PLOT SIDELINE
C
      CALL SIDPLT(SNDL,FPATH(1,3),NP,NDIST,TITLE,NSD,NDIM)
C
C REPEAT PLOT LOOP UNTIL END OF DATA
C
```

```
      GO TO 50
C
C NORMAL RETURN
C
C EMPTY PLOT BUFFER
C
900   CALL PLOT(0.,0.,999)
      RETURN
C
C ABNORMAL TERMINATION
C
901   WRITE(6,3000)
3000  FORMAT(1H0,20H *** FATAL ERROR *** )
      WRITE(6,3001)
3001  FORMAT(1H ,5X,
     X45HPLOT SIZE UNITS MUST BE SPECIFIED AS IN OR CM )
      GO TO 999
902   WRITE(6,3000)
      WRITE(6,3002)
3002  FORMAT(1H ,5X,
     128HINSUFFICIENT DATA ON TAPE2    )
      GO TO 999
905   WRITE(6,3000)
      WRITE(6,3005)
3005  FORMAT(1H ,5X,
     X45HINSUFFICIENT PLOT SPECIFICATION DATA ON CARDS )
999   STOP
      END
```

```
      SUBROUTINE PNDB4(SPL,KIND,PNDB)                                    PNDB4
C PURPOSE              TO CALCULATE THE PERCEIVED NOISE LEVEL OF A SOUND  PNDB4
C                      PRESSURE LEVEL SPECTRUM ACCORDING TO REFERENCE 2   PNDB4
C AUTHOR               J. N. THOMAS                                       PNDB4
C MODIFICATIONS        NONE                                               PNDB4
C                                                                         PNDB4
C METHOD               THIS SUBROUTINE USES THE METHODS AND TABLES IN     PNDB4
C                      ARP-865 (REFERENCE 2). THE SPECTRUM CAN BE         PNDB4
C                      PREFERRED 1/3 OCTAVE, PREFERRED OCTAVE, OR COMMON  PNDB4
C                      OCTAVE BANDS.                                      PNDB4
C                                                                         PNDB4
C USAGE                CALL PNDB4(SPL,KIND,PNDB)                          PNDB4
C                      DIMENSION SPL(1)                                   PNDB4
C                                                                         PNDB4
C INPUTS               SPL - ARRAY OF 24 PREFERRED 1/3 OCTAVE, 8 PREFERRED PNDB4
C                            OCTAVE, OR 8 COMMON OCTAVE SPL VALUES IN DB  PNDB4
C                      KIND - = 1 FOR PREFERRED 1/3 OCTAVE                PNDB4
C                             = 2 FOR PREFERRED OCTAVE                    PNDB4
C                             = 3 FOR COMMON OCTAVE                       PNDB4
C                                                                         PNDB4
C OUTPUTS              PNDB - THE PERCEIVED NOISE LEVEL IN PNDB           PNDB4
C                                                                         PNDB4
C ERROR RETURN         IF KIND DOES NOT EQUAL 1,2, OR 3, THE PNL WILL NOT PNDB4
C                      BE CALCULATED, AND THE FOLLOWING MESSAGE WILL BE   PNDB4
C                      PRINTED6 KIND EQUAL TO --- IS UNDEFINED.  PNDB IS  PNDB4
C                      SET EQUAL TO ZERO AND CONTROL IS RETURNED TO THE   PNDB4
C                      CALLING PROGRAM.                                   PNDB4
C                                                                         PNDB4
C STORAGE              545 BASE EIGHT                                     PNDB4
C TIMING               0.015 CP SECONDS FOR A 24 VALUE SPL ARRAY          PNDB4
C REFERENCES           1. PEART,N.A., REVISED PNL CALCULATION PROCEDURE,  PNDB4
C                         MEMO 6-8580-9-238,JUNE 19,1969                  PNDB4
C                      2. SOCIETY OF AUTOMOTIVE ENGINEERS, AEROSPACE      PNDB4
C                         RECOMMENDED PRACTICE 865A, SAE, AUGUST 15,1969  PNDB4
C                                                                         PNDB4
C SUBROUTINES CALLED                                                      PNDB4
C                      APPLICATIONS - NONE                                PNDB4
C                      SYSTEMS - ALOG10                                   PNDB4
C                                                                         PNDB4
C DOCUMENTATION        AMEP-S-170                                         PNDB4
C                                                                         PNDB4
C     *** RESTRICTIONS ***                                                PNDB4
C      SPL VALUES SHOULD BE LESS THAN 150 DB . IF THEY ARE NOT,           PNDB4
C          NOY VALUES AND PNDB  VALUES WILL BE INCORRECT.                 PNDB4
C                                                                         PNDB4
      REAL LL,MM                                                          PNDB4
      REAL L,M                                                            PNDB4
      DIMENSION L(24,5),M(24,4),SPL(24,17),PNDB(17)                       PNDB4
      DIMENSION LL(120),MM(96)                                            PNDB4
      EQUIVALENCE(LL(1),L(1,1)),(M(1,1),MM(1))                            PNDB4
      DATA  LL              / 49., 44., 39., 34., 30.,27.,24.,21. ,18.,   PNDB4
     1 5*16.,15.,12.,9.,5. ,4. ,5.,6. ,10. ,17. , 21. ,                   PNDB4
     2                        55., 51., 46., 42., 39.,36.,33.,30. ,27.,   PNDB4
     1 5*25.,23.,21.,18.,15.,14.,14.,15.,17.,23.,29. ,                    PNDB4
     3                        64., 60., 56., 53., 51.,48.,46.,44., 42.,   PNDB4
     1 5*40.,38.,34.,32.,30.,29.,29.,30.,31.,37.,41.   ,                  PNDB4
     4                        91.01 , 85.88, 87.32  , 79.85,  79.76 ,     PNDB4
```

```
     1 75.86  ,73.96   ,74.91    ,94.63 , 13*100., 44.29  ,50.72     ,  PNDB4
     5                          52., 51., 49., 47., 46.,45.,43.,42. ,41., PNDB4
     1 5*40.,38.,34.,32.,30.,29.,29.,3C.,31.,34.,37.        /           PNDB4
      DATA  MM             /    .079520   , 2*.068160     , .059640    , PNDB4
     1  10*.053013     ,       .05964C   , 2*.053013     ,  2*.047712  , PNDB4
     2   2*.053013     ,       .068160   ,   .079520     , .0596401  ,  PNDB4
     X                        2*.058098  ,   .052288     , .047534     , PNDB4
     1   2*.043573     ,       .040221   ,   .037349     ,  7*.034859  , PNDB4
     2     .040221     ,       .037349   , 4*.034859     ,  2*.037349  , PNDB4
     3     .043573 ,                                                     PNDB4
     X                         .043478   ,   .040570     , 2*.036831   , PNDB4
     1     .035336     ,      2*.033333  ,   .032051     , .030675     , PNDB4
     2   6*.030103     ,      7*.029960  , 2*.042285     ,               PNDB4
     X                       15*.030103, 9*.029960 /                    PNDB4
      DO 55 JJ=1,17                                                     PNDB4
      SUM=0.                                                            PNDB4
      XMAX=0.                                                           PNDB4
      PNDB(JJ)=0.                                                       PNDB4
      IF(KIND.LT.1.OR.KIND.GT.3) GC TC 6C                               PNDB4
      IF  (KIND-2)  1, 2, 3                                             PNDB4
    1 CONTINUE                                                          PNDB4
      NUM=24                                                            PNDB4
      C=.15                                                             PNDB4
      KK=0                                                              PNDB4
      INC=1                                                             PNDB4
      GC TO 10                                                          PNDB4
    2 CONTINUE                                                          PNDB4
      KK=-1                                                             PNDB4
    4 CONTINUE                                                          PNDB4
      NUM=8                                                             PNDB4
      C=.3                                                              PNDB4
      INC=3                                                             PNDB4
      GC TO 10                                                          PNDB4
    3 CONTINUE                                                          PNDB4
      KK=-2                                                             PNDB4
      GO TO 4                                                           PNDB4
   1C CONTINUE                                                          PNDB4
      DO 50 I=1,NUM                                                     PNDB4
      A=1.                                                              PNDB4
      KK=KK+INC                                                         PNDB4
      DO 20 J=1,4                                                       PNDB4
      IF(SPL(I,JJ).LT.L(KK,J) ) GO TO 21                                PNDB4
   2C CONTINUE                                                          PNDB4
      J=5                                                               PNDB4
      K=5                                                               PNDB4
      GC TO 22                                                          PNDB4
   21 CONTINUE                                                          PNDB4
C IGNORE SPL(I,JJ) IF IT FALLS OFF THE LOWER  END OF THE TABLE,I.E.,J=1 PNDB4
      IF(J.LT.2) GO TO 5C                                               PNDB4
      IF(J.EQ.2) A=.1                                                   PNDB4
      K=J-1                                                             PNDB4
      IF(K.EQ.2) K=3                                                    PNDB4
   22 CONTINUE                                                          PNDB4
      XNOY= A*10.** (M(KK,J-1) * (SPL(I,JJ)-L(KK,K) ) )                 PNDB4
      IF(XNOY.GT.XMAX) XMAX=XNOY                                        PNDB4
      SUM=SUM+XNOY                                                      PNDB4
   50 CONTINUE                                                          PNDB4
```

```
      BARN= XMAX + C* (SUM - XMAX)
C   PNDB CANNOT BE NEGATIVE
      IF(BARN.GT.0.048) PNDB(JJ)=(ALOG10(BARN))/.030103 + 40.
 55   CONTINUE
      RETURN
   60 CONTINUE
      WRITE (6,61) KIND
   61 FORMAT(10X,14HKIND EQUAL TO  ,I4,13H IS UNDEFINED )
      RETURN
      END
```

```
      SUBROUTINE PNLSUB(SP,PS,TP,EP,PL,TL,NK,B,T,F,I,NOBS,IR)
      COMMON /GPRAM/ALTP,ALTR,SLOPE,AMACH,DUM,SLDIST(10),NTENG,IUNIT
     *     ,ISPTRM,IATMOS,IAIR,LAIRAB(24),NTEMP,TEMP(50),TALT(50)
     *     ,NPRES,PRES(50),PALT(50),NHUMID,RALT(50),RHUMID(50),CTEMP
     *     ,CPRES,CRHUMD,IEGA,IGDR,DTEMP,DPRES,CHUMID,XKN,ND,FLD(50),
     * ZNR(50),ZNI(50),LINECT,MAXLIN,IPAGE,BCG,TCG,FLR,AALT,EPF
      DIMENSION SP(24,17), PS(17,11), TP(17), EP(5), PL(1), TL(5),
     1     IR(10,17)
      DATA UND /17770000000000000000B/
      NL=2
      IF(NK.EQ.3)NL=1
      NOBX=NOBS
      CALL PNDB4(SP(1,1),NL,PS(1,1))
      IF(AMACH.NE.0.)GO TO 100
      GO TO 200
  100 CONTINUE
      CALL EPNLI(PS(1,1),TP,17,B,T,F,EP,IER)
      IF(IER.EQ.0)GO TO 300
  200 CONTINUE
      EP(1)=UND
      EP(2)=UND
      EP(3)=UND
      EP(4)=UND
      EP(5)=UND
  300 CONTINUE
      IF(NK.NE.3) GO TO 380
      CALL TONCOR(SP(1,1),PS(1,11),PL,IRR)
      DO 350 N=1,17
  350 PS(N,11)=PS(N,11)+PS(N,1)
      IF(AMACH.NE.0.)GO TO 370
      GO TO 375
  370 CONTINUE
      CALL EPNLI(PS(1,11),TP,17,B,T,F,TL,IER)
      IF(IER.EQ.0)GO TO 390
  375 CONTINUE
      TL(1)=UND
      TL(2)=UND
      TL(3)=UND
      TL(4)=UND
      TL(5)=UND
  390 CONTINUE
  380 CONTINUE
      RETURN
      END
```

```
      SUBROUTINE PRINTH(N,LCT,L)
      COMMON/ICPATH/NCAS,NCOF,NTYP,IC,NRN,IARRAY(2)
      COMMON/HEAD/HIN(20),HOUT(20),CHIN(20)
      DIMENSION HD1(4),HD2(7)
      DATA HD1 /4HPROG,4HRAM ,4HTEE3,4H30A /, ATE /4HDATE/
      DATA HD2/4HAIRC,4HRAFT,4H NOI,4HSE P,4HREDI,4HCTIO,4HN   /
      DATA IENTRY/0/
      IF(IENTRY.EQ.1)GO TO 10
      CALL DATE(DAY)
      IENTRY=1
 10   LCT=5
      WRITE (L,100) HD1, ATE, HD2, DAY
  100 FORMAT(1H1,57X,4A4,50X,A4/53X,7A4/120X,A10)
      WRITE(L,110)NCAS,HOUT
  110 FORMAT(10H CASE NO. ,I3,27X,20A4,1X,8HYR/MO/DA)
      IF(N.EQ.3)GO TO 130
      IF(N.EQ.7)GO TO 130
      WRITE(L,120)
 120  FORMAT(1H )
      GO TO 1000
 130  WRITE(L,140)CHIN
  140 FORMAT(40X,20A4)
 1000 RETURN
      END
```

```
      SUBROUTINE PROP                                                   PROP
C                                                                       PROP
C     PURPOSE             THE FOLLOWING PROPELLER NOISE PREDICTION PROCED PROP
C                         BASED ON THE BELOW LISTED REFERENCES. THE PROCE PROP
C                         CONSIDERS TWO NOISE COMPONENTS. (1)THE VORTEX N PROP
C                         BASED ON THE EQUATIONS IN REFERENCES 1 AND 2.   PROP
C                         (2)DISCRETE TONE NOISE BASED ON REFERENCE 3. TH PROP
C                         RESULTING NOISE ESTIMATES HAVE BEEN CORRECTED T PROP
C                         FREE FIELD  INDEX CONDITIONS  (RADIUS =  1 METE PROP
C                                                                       PROP
C     REFERENCES          1  F.H. SCHMITZ, W.Z.STEPNIEWSKI,J.GIBS,E.HINTE PROP
C                            A COMPARISON OF OPTIMAL AND NOISE ABATEMENT  PROP
C                            TRAJECTORIES OF A TILT ROTOR AIRCRAFT,NASA C PROP
C                            MAY 1972.                                    PROP
C                                                                       PROP
C                         2  F.W.BARRY,B.MAGLIOZZI, NOISE DETECTABILITY P PROP
C                         N METHOD FOR LOW TIP SPEED PROPELLERS (HAMILTON PROP
C                            STANDARD), AFAPL-TR-71-37, JUNE  1971.       PROP
C                                                                       PROP
C                         3  B.MAGLIOZZI, GENERALIZED PROPELLER NOISE EST PROP
C                            PROCEDURE (HAMILTON-STANDARD,REVISION C), 11 PROP
C                                                                       PROP
C     PROGRAMMER          M.A.  JAEGER      NOISE AND PROPULSION GROUP  G- PROP
C     REQUIRED DATA       VARIABLE DEFINITION                       UNITS PROP
C                                                                       PROP
C                         ISPRTM----SWITCH FOR 1/3 OR FULL O.B. (0 OR 1)  PROP
C                         T---------THRUST DEVELOPED BY PROPELLER.   LBF  PROP
C                         W---------POWER GIVEN TO THE PROPELLER          PROP
C                                     SHAFT.                         HP   PROP
C                         RPM-------ROTATIONAL SPEED OF PROPELLER         PROP
C                                     SHAFT.                        RPM   PROP
C                         D---------PROPELLER  DIAMETER              FT   PROP
C                         DSUBE-----CHARACTERISTIC DIMENSION FOR THE      PROP
C                                     BLAD GEOMETRY AT 0.7 SPAN.     FT   PROP
C                                   DSUBE=BT*COS(CL)+CL*ABS(SIN ATTANG)   PROP
C                                     BT= BLADE THICKNESS                 PROP
C                                     CL= CHORD LENGTH                    PROP
C                                     ATTANG= ANGLE OF ATTACK             PROP
C                         ASUBB-----TOTAL BLADE AREA OF PROPELLER   FT**2 PROP
C                                                                       PROP
C                                        ASUBB = B* INTEGRAL(HUB TO TIP)  PROP
C                                                  OF  CL DELTA-R         PROP
C                         B---------NUMBER OF PROPELLER BLADES       NONE PROP
C                         DELTAE----ANGLE BETWEEN PROPELLER AND           PROP
C                                     HORIZON                        DEG. PROP
C                         SLOPE-----CLIMB GRADIENT IE TAN(THETA)     NONE PROP
C                         DOPSF(JJ)-----DOPPLER SHIFT FACTOR (1-AMN*      PROP
C                                     COS(XI).  IF NO DOPPLER SHIFT       PROP
C                         AMACH-----AIRCRAFT MACH NUMBER             NONE PROP
C                                     THEN DOPSF=1.                  NONE PROP
C                         CAMB------AMBIENT SPEED OF SOUND                PROP
C                                       CAMB= K *SQRT(TSO)                PROP
C                                        K=20.04647 M/SEC PER DEG. KELVIN PROP
C                                          49.02142 FT/SEC PER DEG. RANKINE PROP
C                                        TSO= STATIC TEMP    (DEG. R OR K) PROP
C                                          AT ALTITUDE ZO                 PROP
C                         P---------DISTANCE FOR SOUND PROPAGATION        PROP
```

```
C                                      BETWEEN SOURCE AND OBSERVER       FT  PROP
C                            (X,Y,ZSUBN) AIRCRAFT COORDINATE RELATIVE        PROP
C                                      TO THE OBSERVER.                  FT  PROP
C                            BUF--------ARRAY OF CUTOFF FREQUENCIES (HZ)     PROP
C                                     FOR THE SOUND PRESSURE LEVEL           PROP
C                                     SPECTRUM.   LENGTH=25                  PROP
C                                                                            PROP
C                                        FRCCUT(I)=10**(0.1*(I+15.5))    HZ  PROP
C                            NENG-------NUMBER OF PROPELLER ENGINES    NONE  PROP
C                                                                            PROP
C    VARIABLES SET DURING                                                    PROP
C       INITIALIZATION                                                       PROP
C                                                                            PROP
C                            ALPHA-----ANGLE BETWEEN THE THRUST AXIS AND     PROP
C                                     THE DIRECTION OF THE AIRPLANES         PROP
C                                     MOTION                           DEG.  PROP
C                                        ALPHA=DELTAE-ATAN(GRAD)             PROP
C                            SCI--------THE DIRECTIVITY ANGLE                PROP
C                                      ACOS(-(YCOS(DELTAE)+ZNSIN(DELTAE)     PROP
C                                            /F))                      DEG.  PROP
C                            VSUBT-----TIP SPEED                     FT/SEC  PROP
C                                       = PI*RPM*DSUBT / 60                  PROP
C                            XMSUBT----ROTATIONAL TIP MACH NUMBER            PROP
C                            XMSBTR----RELATIVE ROTATIONAL TIP MACH          PROP
C                                      NUMBER                                PROP
C                                      =SQRT XMSUBT**2+(ACMN*COS(ALPHA))**2  PROP
C                                      (DIAGNOSTIC-IF  XMSUBTR GT .9 OR      PROP
C                                       .LE. 0 )                             PROP
C                            VSUBTR----RELATIVE TIP SPEED            FT/SEC  PROP
C                                        = CAMB *X MSUBTR                    PROP
C                            FSUBC------OBSERVED FUNDAMENTAL BLADE PASSAGE   PROP
C                                     FREQUENCY                          HZ  PROP
C                                       = B* RPM/ (60*DOPSF)                 PROP
C                            FSUBV------OBSERVED CHARACTERISTIC FREQUENCY    PROP
C                                     FOR BROADBAND VORTEX NOISE         HZ  PROP
C                                       =0.28*VSUBTR /(DSUBE*DOPSF)          PROP
C                            PSUBI-----ARRAY OF PRESSURE SPECTRA LEVELS      PROP
C                            SPLI -----ARRAY OF SOUND PRESSURE LEVELS I=1,24 PROP
C                            BRING IN INPUT CARD VARIABLES FROM INPUT ROUTIN PROP
C                                                                            PROP
C                                                                            PROP
C                                                                            PROP
C                                                                            PROP
C                                                                            PROP
C                                                                            PROP
C                                                                            PROP
      COMMON/PROPIN/T,W,RPM,D,DSUBE,ASUBB,B,DELTA,                           PROP
     *ICOR10,LIN10,NTF10,IMA10,LGM10,NWL10,IOP10,ILAY10,TF10(10),            PROP
     *PCTA10(10),PLA10(10),ELCH10,ECH10,RIW10(10),TL10(10),CF10,FM10         PROP
      COMMON/SWITCH/NTYPE,ITYPE,NENG,ICOP,IPRT(7),ICN(13),NLCPT              PROP
C     CONSTANTS USED IN INTERNAL CALCULATIONS                                PROP
C                                                                            PROP
      COMMON /GCONST/ IN,IC,IT1,IT2,F0,F1,F2,F3,F4,F5,F6,F7,F8,F9,F10,       PROP
     *               I0,I1,I2,I3,I4,I5,I6,I7,I8,I9,I10,P1,P33,P5,P001,       PROP
     *               EPS,UNDEF,BL,ICD,DFR,RPD,ETA(17),M1,FM1,I17,A,PI        PROP
C                                                                            PROP
C     VARIABLE SET CALCULATED IN THE PROGRAM PROCESSING                      PROP
```

```
C
      COMMON /GCOMON/ NCF,NK,BCF(24),TSPL(24,10,17),SPLT(24,17),
     *BUF(25),RETA(17),SPL2(17),TGAGR(24),CCPSF(17)
      COMMON/SUMSPL/SSPL(24,10,17)
      COMMON/PNLD/PSPL(17,20),EPNL(5,10),TEPNL(5,10)
C
C     FREQUENCY BANDS USED BY PROGRAM
C
      COMMON /GFREQ/ CFREQ(24),UFREQ(25),PFREQ(24)
C
C     GENERAL INPUT PARAMETERS
      COMMON/ANGLE/PSI(17,10),PSIC(17,10),BETA(17,10)
C
      COMMON /GPRAM/ALTP,ALTR,SLOPE,AMACH,NCBS,SLDIST(10),ITENG,IUNIT
     *    ,ISPTRM,IATMOS,IAIR,UAIRAB(24),NTEMP,TEMP(50),TALT(50)
     *    ,NPRES,PRES(50),PALT(50),NHUMIC,RALT(50),RHUMID(50),CTEMP
     *    ,CPRES,CRHUMD,IEGA,IGDR,DTEMP,DPRES,DHUMID,XKN,NC,FLD(50),
     * ZNR(50),ZNI(50),LINECT,MAXLIN,IPAGE,BCG,TCG,FLR,AALT,EPF
C
C     AIRCRAFT-OBSERVER GEOMETRY OUTPUTS
C
      COMMON /GEOMO/ APY(10,17),APZ(10,17),PD(10,17),DPND(10,17),
     * B1(10,17),B2(10,17),TDS(17,10),TPD(17,10),IRR(10,17)
     *,APP,TP,RHP,APO,TO,RHO,CA,CZ,TSP(17,10),CCV
C
C     CONVERSION CONSTANTS
C
      COMMON/GCONVC/C(2,10),SLDISX(10)
      COMMON/TMSPL/SPZ(24,17),IB(2,3,13)
      COMMON/CRSPLS/DOB(17),PSCR(17),CPB(408),NPSCR
      COMMON/HEAD/HIN(20),HOUT(20),CHIN(20)
C
C
C
C
C
      DIMENSION SCIANG(15),DRINDX(15)
      DIMENSION S(25),DA(10)
      DIMENSION HAR(160)
      DIMENSION HARLEV(16,10),AMTE(16)
      EQUIVALENCE (HAR(1),HARLEV(1,1))
C
C
C
C
C                       BUILD TABLE FOR  F OF SCI  CURVES  FOR
C                       DIRECTIVITY CORRECTION.(ANGLE AND CORRECTION)
      DATA DRINDX/-7.1,-4.2,-1.6,-1.0,-1.0,-1.0,-0.8,-0.5,-0.0,0.5,-0.2,
     *-1.6,-4.0,-11.5,-20.6/
      DATA SCIANG/0.0,0.349,0.698,0.872,1.047,1.221,1.396,1.571,1.745,
     *1.919,2.094,2.268,2.44,2.792,3.141/
C                       BUILD TABLE OF ATMOSPHERIC ABSORPTION COEFF.
C                       DELTA K AS A FUNCTION OF K THE BAND NUMBER
C     DATA BLOCKS DEFINING VARIABLES WITH CONSTANT VALUES
C
C
      DATA (HAR(I),I=1,80)/
```

```
     1-C.6,-0.6,-0.6,-C.62,-0.7,-0.75,-0.8,-1.0,-1.2,-1.7,-2.6,-3.2,-3.8 PROP
     *,-4.6,-5.6,-6.7,                                                    PROP
     2-14.,-14.,-14.,-13.7,-13.,-12.1,-10.9,-9.7,-8.4,-7.2,-6.2,-5.8,-5. PROP
     *8,-5.7,-5.8,-5.9,                                                   PROP
     3-18.2,-18.2,-18.,-17.6,-17.2,-16.6,-16.2,-15.6,-14.6,-13.7,-12.3,- PROP
     *11.4,-10.4,-9.2,-7.9,-5.7,                                          PROP
     4-20.,-20.,-19.9,-19.8,-19.5,-19.3,-19.,-18.6,-18.2,-17.6,-16.6,-16 PROP
     *.,-15.,-13.5,-11.,-4.8,                                             PROP
     5-21.9,-21.9,-21.8,-21.6,-21.4,-21.2,-21.,-20.6,-20.2,-19.6,-18.7,- PROP
     *18.,-17.,-15.2,-12.4,-6.3/                                          PROP
      DATA (HAR(I),I=81,160) /                                            PROP
     6-23.,-23.,-23.,-22.9,-22.9,-22.8,-22.6,-22.3,-22.,-21.2,-20.2,-19. PROP
     *4,-18.3,-17.1,-14.4,-8.0,                                           PROP
     7-24.,-24.,-24.,-23.9,-23.9,-23.7,-23.6,-23.4,-22.8,-22.2,-21.4,-20 PROP
     *.8,-20.,-18.6,-16.4,-10.,                                           PROP
     8-25.2,-25.2,-25.2,-25.2,-25.1,-25.,-24.9,-24.8,-24.3,-23.7,-23.,-2 PROP
     *2.2,-21.4,-20.2,-18.,-11.5,                                         PROP
     9-26.8,-26.8,-26.8,-26.8,-26.7,-26.6,-26.5,-26.2,-25.8,-25.2,-24.2, PROP
     *-23.6,-22.9,-21.5,-19.4,-13.,                                       PROP
     0-28.8,-28.8,-28.8,-28.8,-28.7,-28.6,-28.5,-28.2,-27.8,-27.2,-26.2, PROP
     *-25.6,-24.8,-23.6,-21.5,-15.C/                                      PROP
      DATA AMTE/C.3,0.35,C.4,0.45,C.5,C.55,C.6,0.65,0.7,0.75,0.8,0.825,0 PROP
     *.850,0.875,C.9,C.930/                                               PROP
      DATA NMTE/16/, NLAUGK/1C/, WSUBC/1COO./, DSUBC/1.0/                 PROP
C                                                                         PROP
C                                                                         PROP
C                                                                         PROP
C                                                                         PROP
      ICN(1C)=ICN(10)+1                                                   PROP
      DELTAE=DELTA*RPD                                                    PROP
      CALL ANGLES(NOBS,DELTAE)                                            PROP
      ALPHA=DELTAE-ATAN(SLCPE)                                            PROP
      VSUBT=PI*RPM*D*0.C16667                                             PROP
      XMSUBT=VSUBT/CZ                                                     PROP
      X  =  XMSUBT*XMSUBT + AMACH*AMACH                                   PROP
      Y  =  XMSUBT * AMACH * SIN(ALPHA)                                   PROP
      XMSBTR  =  (X * (X*X + 6.*Y*Y))**.1666667                           PROP
      IF(XMSBTR .LE. C. .OR. XMSBTR .GT. 0.93)  CALL ERROR(21)            PROP
      VSUBTR=CZ*XMSBTR                                                    PROP
      X  =  X - C.51*XMSUBT*XMSUBT                                        PROP
      Y  =  C.7 * Y                                                       PROP
      VEEPT7  =  CZ * (X * (X*X + 6.*Y*Y))**.1666667                      PROP
      X11=(VSUBTR*T)**2                                                   PROP
      X33=(1./ASUBB)                                                      PROP
      INCF=NCF+1                                                          PROP
      ONEPLS=1.+XMSBTR                                                    PROP
      CNEMYN=1.-XMSBTR                                                    PROP
      CEE=2.*ALOG(CNEPLS/CNEMYN)                                          PROP
      Z1=W/WSUBC                                                          PROP
      Z2=D/DSUBD                                                          PROP
      DO 25 K=1,10                                                        PROP
   25 DA(K)=TBLU1(XMSBTR,AMTE,HARLEV(1,K),1,16)                           PROP
      DO 9999 II=1,NOBS                                                   PROP
      CALL LINCCR(SPZ(1,1),C,X,X,X,X,X,X,X,X,X,PSI(1,II),NCF,BCF,         PROP
     *  X,X,X,X,X,X,X,ICCRIC,IB(1,1,ITYPE),0,X)                           PROP
      DO 8888 JJ=1,17                                                     PROP
C                                                                         PROP
```

```
C                          CALCULATE THE VARIABLES TO BE USED BY BOTH
C                          ROUTINES
      SCI=PSI(JJ,II)*RPD
     FSUBO = B*RPM/(60.*DOPSF(JJ))
     FSUBV= 0.28*VEEPT7/(DSUBE*DOPSF(JJ))
C                          CALCULATE VORTEX NOISE
C
C
C
C
C
C
     X22=(0.1+( COS(SCI)**2))/0.21698
     OA=10.*ALOG10(X11*X22*X33/DOPSF(JJ))+5.7
     DO 15 I=1,INCF
  15 S(I)=BUF(I)/FSUBV
C                          CALCULATE THE SPECTRUM SHAPE  SS(I)
     DO 20 I=1,NCF
     GA=1.+(ONEPLS*S(I+1))**2
     GB=1.+(ONEMYN*S(I))**2
     GC=1.+(ONEMYN*S(I+1))**2
     GD=1.+(ONEPLS*S(I))**2
     SS=10.*ALOG10(1./CEE*ALOG((GA*GB)/(GC*GD)))
C                          CALCULATE THE RESULTING SOUND PRESSURE LEVEL FO
C                          R VORTEX NOISE AT 500 FT.
     SPLT(I,JJ)=OA+SS
C                          CALCULATE THE RESULTANT PRESSURE SPECTRUM
     TGAGR(I)=10.**(0.1*SPLT(I,JJ))
  20 CONTINUE
C
C
C
C
C
C
C
     F1SCI=TBLU1(SCI,SCIANG,DRINDX,1,15)
C                          LO IS THE REFERENCE SOUND PRESSURE LEVEL
C                          USED TO CALCULATE THE HARMONIC TONES
     XLO=15.5*ALOG10(Z1)-22.65*ALOG10(Z2)-40.*ALOG10(DOPSF(JJ))+38.00
    *  *(XMSBTR)-2.2*B+F1SCI+137.7
     HO=0.1*XLO
     H1=0.1*(XLO+DA(10))
     H2=-2.185434*(DA(9)-DA(10))
C                          FIND THE HARMONICS WITHIN THE BAND,IF ANY
     N1= 1.+ BUF(1)/FSUBO
     DO 60 I=1,NCF
     N2=BUF(I+1)/FSUBO
     IF(N2-N1  .LT. 0) GO TO  50
C
C                          SUM THE HARMONIC TONE ENERGY WITHIN EACH BAND
     DO  45 K=N1,N2
     IF (K .GT. 10) GO TO  40
     DP=10.**(HO+0.1*DA(K))
     GO TO  45
 40   XK=K
     DP=10.**(H1)*(0.1*XK)**H2
```

```
   45 TGAGR(I)=TGAGR(I)+DP
   50 SPLT(I,JJ)  =  TGAGR(I) * FLOAT(NENG)
      IF(SPLT(I,JJ) .LE. 0.)GO TO  61
      SPLT(I,JJ)=10.*ALOG10(SPLT(I,JJ))-SPZ(I,JJ)
      GO TO 62
   61 SPLT(I,JJ)=SPZ(I,JJ)
   62 CONTINUE
      SSPL(I,II,JJ)=PWRSUM(SSPL(I,II,JJ),SPLT(I,JJ))
   60 N1=N2+1
 8888 CONTINUE
      IF(IPRT(7).NE.7) GO TO 8900
      CALL NOISO(IPRT(7),II,NK,10,CHIN,IUNIT,SLDISX(II),PFREQ,
     *     SPLT(1,1),NCF,ITYPE)
 8900 CONTINUE
      DO 65 NF=1,NCF
      DO 65 J=1,17
 65   SPLT(NF,J)=SPLT(NF,J)-TSPL(NF,II,J)
      IF(IPRT(3).NE.3)GO TO 9999
      CALL PNLSUB(SPLT(1,1),PSPL(1,II),TFD(1,II),EPNL(1,II),SPL2,
     *  TEPNL(1,II),NK,BCG,TCG,FLR,II,NCBS,IRR(II,1))
      CALL NOISO(IPRT(3),II,NK,12,CHIN,IUNIT,SLDISX(II),PFREQ,
     *     SPLT(1,1),NCF,ITYPE)
 9999 CONTINUE
      RETURN
      END
```

```
      SUBROUTINE PRTSH1(J,X,LCT,L,K)
      COMMON/CLABEL/CH(2,8)
      DATA CH/4H M. ,4H FT ,4H MIC,4HC PI,4HRC-N,4HCCBA,4H/SQ.,4HR)  ,
     *        4HM.) ,1H ,1HK,1HR,4HATM.,4HPSIA,3HMPS,3HFPS/
      I=1
      IF(J.EQ.1)I=2
      IF  (K-2)  10, 200, 300
10    CONTINUE
      WRITE(L,100)X ,CH(I,1)
100   FORMAT(38X,39HOBSERVED SPECTRA AT SIDELINE DISTANCE= ,1PE10.3,
     *   A4//)
      LCT=LCT+3
      GO TO 200
      ENTRY PRTSH2
 200  WRITE(L,210)(CH(I,N),N=2,5)
210   FORMAT(2X,9HFREQUENCY,43X,21HSOUND PRESSURE LEVELS/9H    (KHZ),
     *46X,10H(DB RE. 20,4A4/)
      LCT=LCT+3
      RETURN
300   WRITE(L,310)
310   FORMAT(2X,9HFREQUENCY ,34X,
     *37HSOUND PRESSURE LEVEL ATTENUATION (DB)   //9H    (KHZ) /)
      LCT=LCT+1
      LCT=LCT+2
      RETURN
      END
```

```
      FUNCTION PWRSUM(SPL1,SPL2)
C AUTHOR              D. F. MELDRUM
C
C PURPOSE             TO CALCULATE A POWER SUM
C
C INPUTS              SPL1, SPL2       TWO SPL VALUES WHICH NEEDS TO BE
C                                      ADDED TOGETHER - ONE MAY BE A SUM.
C
C OUTPUTS             PWRSUM     POWER SUM OF SPL1 AND SPL2 - IF ONE
C                                      IS ZERO THE OTHER WILL BE RETURNED AS
C                                      THE POWER SUM. IF BOTH ARE ZERO THE
C                                      SUM WILL BE ZERO.
C
C FUNCTION SUBPRGM    ALOG10
C
C
C
      ANSWER=10.0*ALOG10(10.0**(SPL1*0.1)+10.0**(SPL2*0.1))
C
  300 PWRSUM=ANSWER
      RETURN
      END
```

```
      SUBROUTINE REFRACT(AMACH,PSIO,ETA,DLT,RO,ROV,BV,U,V,W,E1,E2,E3,THO
     1                       ,ROP,THOP)
C
C  TITLE
C     JET REFRACTION EFFECTS
C
C  PURPOSE
C     THIS SUBROUTINE COMPUTES THE JET FLOW REFRACTION EFFECTS BY
C     GIVING THE APPARENT SOURCE POLAR COORDINATE WITH JET FLOW REMOVED
C
C  INPUT - CALLING SEQUENCE
C     AMACH     AIRCRAFT MACH NUMBER
C     PSIO      DIRECTIVITY ANGLE GRAZING WING EDGES
C     ETA       DIRECTION ANGLE RELATIVE TO EDGE
C     DLT       NOT USED, FORMULA      ASIN(W(2))      USED INSTEAD.
C     RO        MAGNITUDE OF VECTOR OF INLET OR NOZZLE RELATIVE TO EDGE
C     ROV       VECTOR OF INLET OR NOZZLE RELATIVE TO EDGE
C     BV        VECTOR FOR A POINT ON THE EDGE RELATIVE TO NOZZLE
C     U,V,W     UNIT VECTORS OF WING EDGE
C     E1,E2,E3  COORDINATE SYSTEM UNIT VECTORS FIXED TO ENGINE SUCH THAT
C               E1 IS PARALLEL TO HALF-PLANE
C
C  INPUT - COMMON
C     EWGEO     VARIABLE DIANI
C     REFRAC    ALL VARIABLES EXCEPT IWED ARE USED
C
C  OUTPUT
C     ROP       MAGNITUDE OF APPARENT SOURCE COORDINATE WITH JET FLOW
C               REMOVED
C     THOP      PHASE ANGLE OF APPARENT SOURCE COORDINATE WITH JET FLOW
C               REMOVED
C
C  NOTE
C     ALL INPUT AND OUTPUT ANGLES ARE IN DEGREES
C
C  REFERENCE
C     THE WEGSTEIN ITERATION SCHEME IS USED. THE CODE IS EXTRACTED FROM
C     IBM SYS/360 SCIENTIFIC SUBROUTINE PACKAGE, VER. III, H20-0166-5,
C     1968, PP.215-216
C
      DIMENSION ROV(3),U(3),V(3),W(3),E1(3),E2(3),E3(3),
     *           RV(3),RCAPV(3),X(5),RPV(3),      ROPV(3),BV(3)
      COMMON/EWGEO/ SWPTE,SWPLE,DIHED,DDSD,DDX1D,DDX2D,DDXOD,DDY1D,
     1              DDY2D,DDYOD,DDLD,DIANI
      COMMON/REFRAC/EMJ,TSTSO,IWED(3),FASS(24),BETA(24),CPSIO(24),NASRO,
     * ASF,IWSFE
      DATA IO, I1, FO, F1, RPD, DPR /0,1,0.,1.,1.745329E-2,57.29578/
      DATA OMEGA, EPS, MAXIT / 1.E75,1.2E-5,50/
C
C     INITIALIZATION
C
      DEL=DLT
      DEL  =  DPR * ASIN(W(2))
      X(1) = AMACH
      X(2) = EMJ
      X(3) = TSTSO
      X(5) = 180. - PSIO
```

```
      SMJ   = X(2) * X(2)
      CR    = SQRT( X(3) )
      RM    = CR * X(2) - X(1)
      CTO   = COS( RPD * X(5) )
      STO   = SQRT( F1 - CTO*CTC )
      IF  (ABS(STO) .LT. EPS)  STO = EPS
      COTPO  =  -CTO / STO
      ACF  =  TBLU1(COTPC, CPSIO, FASS, 1, NASRC)
      CE=COS(ETA*RPD)
      RCP=RC
      THOP=THO
      IF((EMJ.EQ.AMACH.AND.TSTSO.EQ.1.).OR.(ABS(CE).LT.EPS))RETURN
      TEMP=RO*SIN(ETA*RPD)/CE
      DO 1  J=1,3
      RV(J) = RCV(J) + TEMP * L(J)
    1 CONTINUE
      TEMP1=DOTP(E1,U)
      TEMP=DOTP(BV,E1)
      IF  (ABS(TEMP1) .GT. EPS)  GO TO 320
      DO  310  J = 1,3
      RCAPV(J)  =  BV(J) - TEMP * E1(J)
  310 CONTINUE
      GO TO 340
  320 TEMP  =  TEMP / TEMP1
      DO  330  J = 1,3
      RCAPV(J)  =  BV(J) - TEMP * L(J)
  330 CONTINUE
  340 RCAPM  =  SQRT(DOTP(RCAPV, RCAPV))
      GAMO = 180. - ACOS( RCAPV(2) / RCAPM) * DPR
      R     = SQRT( DOTP( RV,RV) )
      X(4) = R / DIANI
      CTTP = CTO / (STC - C.5 / X(4))
      DU   = 2. * X(4) / STO
      TM1  = DU * CTTP
      TM2  = F1 - DU
C
C  CRITICAL ANGLE CALC.
      CP2  =  F1 / (RM + CR)
      IF(ABS(CP2).GT.1.) CP2 = SIGN(1.,CP2)
      SP2  =  SQRT(F1 - CP2*CP2)
      DX  =  ATAN(SP2 / (X(1) + CP2)) * DPR
      AC  =  X(5) + ACF * (DX - (ASF + X(5)))
      IF  (X(5) - AC)  220, 220, 5
    5 I  =  -I1
      K  =  2
      DX  =  FC
C
C  FIRST FUNCTION EVALUATION
   10 COTT1  =  TM1 + TM2 * DX
      CT1  =  COTT1 / SQRT(F1 + COTT1*COTT1)
      ST1S  =  F1 - CT1*CT1
      RAD  =  F1 - SMJ * ST1S
      IF  (RAD)  20, 20, 30
   20 CP1  =  -F1 / X(2)
      GO TO 40
   30 CP1  =  -X(2) * ST1S + CT1 * SQRT(RAD)
   40 CP2  =  RM * CP1 + CR
```

```
      IF  (CP2)  50, 60, 50
   50 CP2  =  CP1 / CP2
      SP2  =  F1 - CP2*CP2
      IF  (SP2)  60, 60, 70
   60 CP2  =  -F1 / (RM + CR)
      CP2  =  .5 * (CP2 + CTC)
      SP2  =  F1 - CP2*CP2
      IF  (SP2)  65, 65, 70
   65 COTT  =  -OMEGA
      GO TO 180
   70 SP2  =  SQRT(SP2)
      COTT  =  (X(1) + CP2) / SP2
   80 IF  (I)  90, 110, 160
C
C  WEGSTEINS ITERATION
   90 DU  =  COTT - DX
      IF  (ABS(DU) - EPS * ABS(COTT))  180, 180, 100
  100 DV  =  -DU
      DX  =  COTT
      I  =  I0
C
C  SECOND FUNCTION EVALUATION
      GO TO 10
  110 DY  = DX - COTT
      I  =  I1
      IF  (ABS(DY) - EPS * ABS(COTT))  180, 180, 120
  120 K  =  K + I1
      IF  (K - MAXIT)  130, 130, 180
  130 IF  (DY)  140, 180, 140
  140 DV  =  DV / DY - F1
      IF  (DV)  150, 180, 150
  150 DU  =  DU / DV
      DX  =  DX + DU
      DV  =  DY
C
C  THIRD TO MAXIT FUNCTION EVALUATIONS
      GO TO 10
  160 DY  =  DX - COTT
      RAD  =  ABS(DX) * EPS
      IF  (ABS(DU) - RAD)  170, 170, 120
  170 IF  (ABS(DY) - 10.*RAD)  180, 180, 120
  180 DX  =  COTT
      IF  (DX)  190, 200, 210
  190 DX  =  180. + DPR * ATAN(F1 / DX)
      GO TO 220
  200 DX  =  90.
      GO TO 220
  210 DX  =  DPR * ATAN(F1 / DX)
  220 DX  =  X(5) + ACF * (DX - (ASF + X(5)))
  221 CT  =  COS(RPD * DX)
      ST  =  SQRT(F1 - CT*CT)
      RAD  =  X(1) * ST
      RAD  =  F1 - RAD*RAD
      IF  (RAD)  223, 223, 225
  223 CP2  =  -F1 / X(1)
      GO TO 227
  225 CP2  =  -X(1) * ST * ST + CT * SQRT(RAD)
```

```
  227 IF(ABS(CP2).GT.1.) CP2 = SIGN(1.,CP2)
      SP2 = SQRT(F1-CP2*CP2)
      IF(ABS(SP2).LT.EPS)SP2=EPS
C
C  NEW SOURCE AXIAL LOCATION VECTOR GRAZING WING EDGE.
      RPV(1) = RV(1)
      RPV(2)  =  -R * STO * CP2 / SP2
      RPV(3) = RV(3)
C
C     CALCULATE EFFECTS FOR PRESENCE OF THE WING, RELATIVE FLOW
C     TURNING AND DUCTING AND COMPUTE OUTPUT COORDINATES
C
      RCAPV(2)  =  RCAPV(2) + (RPV(2) - RV(2))
      COSG1  =  -RCAPV(2) / SQRT(DOTP(RCAPV, RCAPV))
      GAM1  =  ACOS(COSG1) * DPR
      BETAX=TBLU1(COTPC,CPSIC,BETA,1,NASRO)
      BETAX  =  AMIN1(BETAX, DDYOD+DDYCD - 0.088)
      SING1  =  SQRT(F1 - COSG1*COSG1)
      IF(ABS(SING1).LT.EPS)SING1=EPS
      COTG1=COSG1/SING1
      DL=.5*DIANI*BETAX
      SGPD=SIN((GAM1+DEL)*RPD)
      IF  (ABS(SGPD) .LT. EPS)  GO TO 820
      SDEL  =  W(2)
      CDEL  =  SQRT(F1 - W(2)*W(2))
      SGMGO=SIN((GAM1-GAMO)*RPD)
      DL=(DL*SING1*CDEL-RCAPM*SDEL*SGMGO)/SGPD
      CL=DL*COTG1
      GO TO 830
  820 CL=0.0
  830 CONTINUE
C
C     MODIFY  COMPONENTS OF RPV IN DIRECTION OF FLOW AND NORMAL TO
C     HALF-PLANE FOR EFFECT OF WING PRESENCE, I.E. ADD TERMS (CL, DL)
C
      P1 = DOTP(RPV,E1)
      P2 = DOTP(RPV,E2)+CL
      P3 = DOTP(RPV,E3)+DL
      DO 850 J=1,3
      RPV(J) = P1*E1(J) + P2*E2(J) + P3*E3(J)
  850 CONTINUE
      TEMP  =  DOTP(RPV, U)
      DO 860 J=1,3
      ROPV(J) = RPV(J) - TEMP * U(J)
  860 CONTINUE
C
C  COMPUTE APPARENT SOURCE POLAR COORDINATES RE. H.P.
      ROP  =  SQRT(DOTP(ROPV, ROPV))
      THOP  =  DPR * ACOS(DOTP(ROPV,V) / ROP)
C
      RETURN
      END
```

```
      SUBROUTINE RESCAL(NUMBER,ARRAY)
C AUTHOR              D. F. MELDRUM
C
C PURPOSE             TO RESCALE THE INDEPEND VARIABLE FOR THE BASIC DATA
C                     CURVES FOR DISCRETE TONES AND BROADBAND TO A LOG
C                     SCALE.
C
C INPUTS              NUMBER     NUMBER OF POINTS TO RESCALE.
C                     ARRAY      ARRAY OF VARIABLES TO RESCALE.
C
C OUTPUTS             ARRAY      LOG OF THE INPUT ARRAY.
C
C FUNCTION SUBPRGM    ALOG10
C
C
      DIMENSION ARRAY(NUMBER)
      DO 100 I=1,NUMBER
  100 ARRAY(I)=ALOG10(ARRAY(I))
      RETURN
      END
```

```
      SUBROUTINE SDSPLP(DISTX,NPSIX,PSIX,MAXPSI,NCF,USPL,NPSI,PSI,
     1                  DLTSPL)
C  TITLE
C     SHIELDING ATTENUATION
C
C  PURPOSE
C     THIS SUBROUTINE COMPUTES THE SHIELDING ATTENUATION GIVEN THE
C     SHIELDED MEAN SQUARE PRESSURE PER FLIGHT POSITION AND
C     FREQUENCY SUMMED OVER THE EDGES AND X-COORDINATE
C
C  INPUT
C     DISTX     AIRCRAFT COORDINATE DISTANCE X
C     NPSIX     NUMBER OF PSIX
C     PSIX      ARRAY OF DIRECTIVITY ANGLES AT WHICH USPL ARE GIVEN
C     MAXPSI    COLUMN DIMENSION OF USPL
C     NCF       NUMBER OF FREQUENCIES BCF
C     USPL      UNSHIELDED SPL VERSUS PSIX AND FREQUENCIES IN BCF
C     NPSI      NUMBER OF PSI
C     PSI       ARRAY OF DIRECTIVITY ANGLES AT WHICH DLTSPL ARE GIVEN
C     DLTSPL    UPON INPUT, THIS IS ARRAY OF PS2 VERSUS FREQUENCY AND PSI
C
C OUTPUT
C     DLTSPL    UPON OUTPUT, THIS IS THE SHIELDING ATTENUATION VERSUS
C               FREQUENCY AND PSI
C
C
      COMMON/EWGEO/DMY(12),IES
C
      DIMENSION PSIX(1),USPL(MAXPSI,1),PSI(1),DLTSPL(24,1)
C
      C = 0.
      IF(DISTX.NE.0..AND.IES.EQ.0)C=3.
C
C     LOOP ON FREQUENCY AND DIRECTIVITY ANGLE PSI
C
      DO 100 IF=1,NCF
      DO 100 IPSI=1,NPSI
C
C     COMPUTE UNSHIELD SPL AT THIS FREQUENCY AND PSI BY INTERPOLATION
C
      USPLI=TBLU1(PSI(IPSI),PSIX,USPL(1,IF),2,NPSIX)
C
C     COMPUTE TOTAL SHIELDED SOUND PRESSURE AND SUBTRACT FROM UNSHIELDED
C     TO FORM THE SHIELDED ATTENUATION
C
      SSPL = 0.
      PT2 = DLTSPL(IF,IPSI)
      IF( PT2.GT.0. ) SSPL = 10.*ALOG10( PT2 ) - C
      DLTSPL(IF,IPSI) = USPLI - SSPL
  100 CONTINUE
C
      RETURN
      END
```

```
      SUBROUTINE SHATTN(AMACH,CZ,NCF,BCF,NPSIX,PSIX,MAXPSI,USPL,ISPTRM,  SHATTN
     1                  DISTX,APY,APZ,ALTR,NPSI,PSI,DELT3,ITYPE,DLTSPL)  SHATTN
C                                                                         SHATTN
C  TITLE                                                                  SHATTN
C     WING SHIELDING CALCULATION MODULE                                   SHATTN
C                                                                         SHATTN
C  PURPOSE                                                                SHATTN
C     THIS SUBROUTINE CALCULATES WING SHIELDING DELTA-SPL WHICH CONSISTS SHATTN
C     OF THE FOLLOWING SUB-TASKS OR MODULES                              SHATTN
C          MULTIPLE EDGES                                                 SHATTN
C          JET REFRACTION                                                 SHATTN
C          UNIFORM FLOW                                                   SHATTN
C          EDGE DIFRACTION                                                SHATTN
C                                                                         SHATTN
C  INPUT - CALLING SEQUENCE                                               SHATTN
C     AMACH  - AIRCRAFT MACH NUMBER FROM COMMON GPRAM                     SHATTN
C     CZ     - AMBIENT SPEED OF SOUND AT AIRCRAFT ALTITUDE                SHATTN
C              FROM COMMON GEOMO                                          SHATTN
C     NCF    - NUMBER OF FREQUENCIES, 8 OR 24                             SHATTN
C     BCF    - 1/3 O. B. OR FULL O. B. GEOMETRIC MEAN CENTER FREQUENCIES SHATTN
C              FROM COMMON GEOMON                                         SHATTN
C     NPSIX  - NUMBER OF DIRECTIVITY ANGLES IN PSIX BELOW AT MOST MAXPSI SHATTN
C     PSIX   -  DIRECTIVITY ANGLES IN DEGREES AT WHICH USPL ARE DEFINED  SHATTN
C              BELOW                                                      SHATTN
C     MAXPSI - COLUMN OR VARIABLE DIMENSION OF USPL                       SHATTN
C     USPL   - UNSHIELDED SPL VERSUS PSIX AND BCF MATRIX IN THAT ORDER   SHATTN
C              AT STATIC CONDITIONS. THESE MAY BE OBTAINED FROM INPUT,   SHATTN
C              TABLE OR PREDICTED VALUES                                  SHATTN
C     ISPTRM - FILTER BAND WIDTH INDICATOR FROM COMMON GPRAM              SHATTN
C              = 0 USE .1 FOR 1/3 OCTAVE BANDS                            SHATTN
C                1 USE .3 FOR FULL OCTAVE BANDS                           SHATTN
C     DISTX  - AIRCRAFT COORDINATE DISTANCE X FROM COMMON GPRAM  FOR     SHATTN
C              THIS OBSERVER POSITION, I.E. A VALUE FROM SLDIST          SHATTN
C     APY    - ARRAY OF 17 AIRCRAFT COORDINATES Y FROM COMMON GEOMC FOR  SHATTN
C              THIS OBSERVER, A ROW FROM APY                              SHATTN
C     APZ    - ARRAY OR 17 AIRCRAFT COORDINATES Z FROM COMMON GEOMC FOR  SHATTN
C              THIS OBSERVER, A ROW FROM APZ                              SHATTN
C     ALTR   - OBSERVER HEIGHT FROM COMMON GPRAM                          SHATTN
C     NPSI   - NUMBER OF DIRECTIVITY ANGLES PSI BELOW (SHOULD BE 17)     SHATTN
C     PSI    - DIRECTIVITY ANGLES RELATIVE TO ENGINE INLET PHI FOR SOUND SHATTN
C              PROPAGATING TO THE OBSERVER (DEG)                          SHATTN
C     DELT3  - ENGINE INCLINATION ANGLE RELATIVE TO HORIZION (DEG)        SHATTN
C     ITYPE  - = 4 FOR INLET FAN NOISE                                    SHATTN
C              NOT 4 FOR DISCHARGE TURBOMACHINERY NOISE                   SHATTN
C                                                                         SHATTN
C  INPUT - COMMON                                                         SHATTN
C     EWGEO  - ENGINE/WING GEOMETRY VARIABLES                             SHATTN
C     REFRAC - NOISE COMPONET REFRACTION VARIABLES                        SHATTN
C                                                                         SHATTN
C  OUTPUT                                                                 SHATTN
C     DLTSPL - ARRAY OF SHIELDING DELTA-SPL VERSUS BCF AND PSI, 24 BY 17 SHATTN
C                                                                         SHATTN
      DIMENSION BCF(1),PSIX(1),USPL(MAXPSI,1),APY(1),APZ(1),PSI(1),      SHATTN
     1          DLTSPL(24,1)                                              SHATTN
      COMMON/EWGEO/ SWPTE,SWPLE,DIHED,COSD,DCX1D,DCX2D,DCXOD,DDY1D,      SHATTN
     1              DDY2D,DDYOD,DDLD,DIANI,IES                            SHATTN
      COMMON/REFRAC/EMJ,TSTSC,IWED(3),FASS(24),BETA(24),CPSIC(24),NASRO, SHATTN
```

```
     * ASF,IWSFE
C
      DIMENSION U(3),V(3),E1(3),E2(3),E3(3), ROV(3),ZEON(17),PN(3),W(3)
     *          ,AF(3),BV(3)
C
C  TEST TO SEE IF FLIGHT EFFECTS FOR WING SHIELDING ARE NOT TO BE USED.
      AMACH  =  TMACH
      IF  (IWSFE .NE. 0)  AMACH = 0.
C
C     INITIALIZE DLTSPL TO ZERO FOR ACCUMULATION OF PS2
C
      DO 90 IP=1,17
      DO 90 IF=1,24
      DLTSPL(IF,IP) = 0.
   90 CONTINUE
C
C     LOOP ON THE EDGES THAT ARE TURNED ON
C
      DO 1000 IEDGE=1,3
      IF( IWED(IEDGE).EQ.0 ) GO TO 1000
C
C     COMPUTE THE ENGINE/EDGE GEOMETRY
C
      CALL EEGEOM(IEDGE,ITYPE,
     1             U,V,W,E1,E2,E3,RO,THO,ROV,BV,DLT,ALP,ALPO,AF)
C
C     LOOP ON DISTX, ALWAYS EXECUTE THE LOOP ONCE AND WHEN DISTX IS
C     NOT ZERO, SET NEGATIVE AND RE-EXECUTE
C
      X = DISTX
      DO 900 IX=1,2
      IF( IX.EQ.1) GO TO 210
      IF(X.EQ.0.)GO TO 900
      IF(IES.NE.0)GO TO 900
      X = -X
  210 CONTINUE
C
C     LOOP ON THE FLIGHT PATH POSITION
C
      DO 800 IPSI=1,NPSI
C
C     CORRECT AIRCRAFT HEIGHT FOR OBSERVER HEIGHT
C
      ZEON(IPSI) = APZ(IPSI) - ALTR
C
C     COMPUTE EDGE/OBSERVER GEOMETRY
C
      CALL EOGEOM(  X   ,APY(IPSI),ZEON(IPSI),DELT3,U,V,W,THO,DLT,ALP,
     1             ETA,TH,PSIO,PN)
C
C     TEST FOR INLET FAN (NO REFRACTION)
C
      IF(ITYPE.NE.4)GO TO 300
      ROP=RO
      THOP=THO
      GO TO 400
C
```

```
C     COMPUTE JET FLOW REFRACTION EFFECTS                               SHATTN
C                                                                       SHATTN
  300 CALL REFRACT(AMACH,PSIO,ETA,DLT,RO,RCV,BV,U,V,W,E1,E2,E3,THO,     SHATTN
     1             ROP,THOP)                                            SHATTN
C                                                                       SHATTN
C     COMPUTE UNIFORM FLOW EFFECTS                                      SHATTN
C                                                                       SHATTN
  400 CALL  UNIFLW(AF,U,V,W,AMACH,RCP,THCP,TH,ETA,PSI(IPSI),ALP,DLT,    SHATTN
     1             GAM,ROPP,THOPP,THP,ETAP,TLE,PSIO,PSIOP)              SHATTN
C                                                                       SHATTN
C     SET FILTER BANDWIDTH AND LOOP ON FREQUENCY                        SHATTN
C                                                                       SHATTN
      BW = .1                                                           SHATTN
      IF(ISPTRM.EQ.1)BW=.3                                              SHATTN
      DO 700 IF =1,NCF                                                  SHATTN
C                                                                       SHATTN
C     COMPUTE EDGE DIFFRACTION                                          SHATTN
C                                                                       SHATTN
      CALL EDGEDI(NPSIX,PSIX,BCF(IF),       LSPL(1,IF),CZ,THP,          SHATTN
     1             GAM,ROPP,THOPP,ETAP,PSIO,PSIOP,BW,TLE,               SHATTN
     2             PS2)                                                 SHATTN
C                                                                       SHATTN
C     SUPERPOSITION OF EDGE SOLUTIONS AND X LOOP ALSO                   SHATTN
C                                                                       SHATTN
      DLTSPL(IF,IPSI) = DLTSPL(IF,IPSI) + PS2                           SHATTN
C                                                                       SHATTN
C     END ALL FOUR LOOPS                                                SHATTN
C                                                                       SHATTN
  700 CONTINUE                                                          SHATTN
  800 CONTINUE                                                          SHATTN
  900 CONTINUE                                                          SHATTN
 1000 CONTINUE                                                          SHATTN
C                                                                       SHATTN
C     COMPUTE TOTAL SOUND PRESSURE LEVEL AND THE ATTENUATION DUE TO     SHATTN
C     WING SHIELDING FOR EACH FREQUENCY AND FLIGHT PATH POSITION        SHATTN
C                                                                       SHATTN
      CALL SDSPLP(DISTX,NPSIX,PSIX,MAXPSI,NCF,LSPL,NPSI,PSI,            SHATTN
     1             DLTSPL)                                              SHATTN
C                                                                       SHATTN
      RETURN                                                            SHATTN
      END                                                               SHATTN
```

```
      SUBROUTINE SHELL(X,K,N)                                            SHELL
C     S01204   SHELL    PS-481      STD SUB DEV GRP  670511 6600         SHELL
C                                                                        SHELL
C AUTHOR              R.H.HAVIG                                          SHELL
C                                                                        SHELL
C     FORTAN IV SUBROUTINE SHELL ORDERS ARRAY X IN ASCENDING MANNER      SHELL
C          X IS THE ARRAY TO BE ORDERED                                  SHELL
C          N IS THE LENGTH OF X                                          SHELL
C          K WILL BE AN INDEX ARRAY FOR ORDERING DEPENDENT ARRAYS        SHELL
C**** TYPE X AND TEMP AS INTEGER IF X IS INTEGER ARRAY                   SHELL
      DIMENSION X(1),K(1)                                                SHELL
      INTEGER K                                                          SHELL
C  IBM SYS360 + 370                                                      SHELL
C     REAL*8 X, TEMP                                                     SHELL
      IF(N.LE.0)RETURN                                                   SHELL
C     ASSIGN INTEGERS 1 THRU N INTO ARRAY K                              SHELL
      DO  1000  J=1,N                                                    SHELL
 1000 K(J)=J                                                             SHELL
      M=N                                                                SHELL
 1010 M=M/2                                                              SHELL
      IF (M) 1070,1070,1020                                              SHELL
 1020 NM=N-M                                                             SHELL
      DO  1060  J=1,NM                                                   SHELL
 1030 I=J                                                                SHELL
 1040 L=I+M                                                              SHELL
      IF (X(I)-X(L))  1060,1060,1050                                     SHELL
C     EXCHANGE  X(I) WITH X(L)                                           SHELL
 1050 TEMP=X(I)                                                          SHELL
      X(I)=X(L)                                                          SHELL
      X(L)=TEMP                                                          SHELL
C          EXCHANGE K(I)  WITH K(L)                                      SHELL
      NTEMP=K(I)                                                         SHELL
      K(I)=K(L)                                                          SHELL
      K(L)=NTEMP                                                         SHELL
      I=I-M                                                              SHELL
      IF (I-1) 1060,1040,1040                                            SHELL
 1060 CONTINUE                                                           SHELL
      GO TO  1010                                                        SHELL
 1070 CONTINUE                                                           SHELL
C     WRITE (6,100)(K(I),I=1,N)                                          SHELL
 9000 FORMAT(5(3X,I5)   )                                                SHELL
      RETURN                                                             SHELL
      END                                                                SHELL
```

```
      SUBROUTINE SHELXH(Y,K,DUM,N)                                        SHELXH
C      AUTHOR   R.H. HAVIG                                                SHELXH
C      PURPOSE   TO ORDER ARRAY Y ACCCRDING TO THE INDEX OF THE K ARRAY   SHELXH
C      THIS SUBROUTINE IS A MODIFIED VERSION OF THE SHELLX VERSION 1      SHELXH
C      PS-481  THE WORKING ARRAY DUM IS PASSED THROUGH TEH CALLING        SHELXH
C      SEQUENCE                                                           SHELXH
C                                                                         SHELXH
C      INPUTS      Y = THE ARRAY TO BE ORDERED                            SHELXH
C                  K = INDEX ARRAY USED TO ORDER Y ARRAY                  SHELXH
C                  DUM = WORKING ARRAY WIT LENGTH EQUAL TO Y ARRAY        SHELXH
C                  N = LENGHT OF ARRAY Y,K,DUM                            SHELXH
C                  Y = ORDERED ARRAY                                      SHELXH
      DIMENSION Y(1),K(1),DUM(1)                                          SHELXH
      INTEGER K                                                           SHELXH
      DO  1000  J=1,N                                                     SHELXH
      L=K(J)                                                              SHELXH
 1000 DUM(J)=Y(L)                                                         SHELXH
      DO  1010  J=1,N                                                     SHELXH
 1010 Y(J)=DUM(J)                                                         SHELXH
      RETURN                                                              SHELXH
      END                                                                 SHELXH
```

```
      SUBROUTINE SHLDSP(AMACH,ALTR,ISPTRM,CZ,SLDIST,IOBS,APY,APZ,DOPSF,  SHLDSP
     *                  SPLT,NCF,BCF,SPZ,PSI,ITYPE,DELT3,ISW3)           SHLDSP
C     PURPOSE          TO ADD TO THE SPL EVALUATED FOR EACH OF THE       SHLDSP
C                      NOISE COMPONENTS AFT ,CORE,INLET,AND TURBINE      SHLDSP
C                      THE ATTENUATION DUE TO WING SHIELDING(ECW ONLY)   SHLDSP
C                      THE SHIELDING ATTENUATION SPECTRUM IS DETERMINED  SHLDSP
C                      BY A CALL TO SUBROUTINE SHATTN.                   SHLDSP
C                      THE ATTENUATION IS DOPPLER SHIFTED,AND SUMMED     SHLDSP
C                      WITH THE CONFIGURATION CORRECTION TO GIVE THE     SHLDSP
C                      TOTAL CORRECTION WHICH IS THEN APPLIED TO THE     SHLDSP
C                      BARE ENGINE SPL                                   SHLDSP
C                                                                        SHLDSP
C     INPUT APPLICABLE TO SHLDSP                                         SHLDSP
C                                                                        SHLDSP
C         DOPSF        ARRAY OF DOPPLER SHIFT FACTORS                    SHLDSP
C         ISPTRM       =0 FOR 24 PREFERRED 1/3 OCTAVE BANDS              SHLDSP
C                      =1 FOR 8 PREFERRED 1/1 OCTAVE BANDS               SHLDSP
C         ITYPE        NOISE COMPONENT INDICATOR                         SHLDSP
C                      =4 INLET FAN                                      SHLDSP
C                      =5 AFT FAN                                        SHLDSP
C                      =3 CORE OR TURBINE                                SHLDSP
C         ISW3         INDICATES WHEATHER CORE OR TURBINE                SHLDSP
C                      =2 CORE NOISE ONLY                                SHLDSP
C                      =3 TURBINE NOISE ONLY                             SHLDSP
C         NCF          NO. OF REQUENCY BANDS 8 OR 24                     SHLDSP
C         IOBS         THE ITH OBSERVER REFERENCE                        SHLDSP
C         SPLT         A MATRIX OF UNSHIELDED SPL SPECTRA AT             SHLDSP
C                      FLIGHT INDEX CONDITION                            SHLDSP
C         SPZ          CONFIGURATION CORRECTIONS AT FLIGHT CONDITIONS    SHLDSP
C                                                                        SHLDSP
C     INPUT APPLICABLE TO WING SHIELDING ATTENUATION                     SHLDSP
C                                                                        SHLDSP
C         AMACH        AIRCRAFT MACH NO                                  SHLDSP
C         CZ           AMBIENT SPEED OF SOUND AT A/C ALTITUDE ZC         SHLDSP
C         DELT3        ENGINE ATTITUDE ANGLE RE TO HORIZON               SHLDSP
C         SLDIST       SIDE LINE DIST. REL. TO THE OBSERVER              SHLDSP
C         APY          A/C CORDINATES RELATIVE                           SHLDSP
C         APZ          TO EACH OBSERVER POSITION                         SHLDSP
C         ALTR         OBSERVER HEIGHT ABOVE GROUND                      SHLDSP
C         NPSI         NO OF DIRECTIVITY ANGLES                          SHLDSP
C         PSI          DIRECTIVITY ANGLES RE TO ENGINE INLET C.L.        SHLDSP
C         BCF          1/3 OR 1/1 OCTAVE BAND GEOMETRIC MEAN FREQUENCIES SHLDSP
C                                                                        SHLDSP
C     INPUT FROM LABELED COMMON UNSHLD                                   SHLDSP
C                                                                        SHLDSP
C         USPLA        EMPIRICAL DIRECTIVITY CURVE OF UNSHIELDED SPL     SHLDSP
C         FSI          AT STATIC CONDITIONS(BUILT-IN VALUES)             SHLDSP
C         NUSPL        NUMBER OF POINTS IN THE EMPIRICAL CURVE           SHLDSP
C         INUSP        INDICATOR TO DECIDE THE DIRECTIVITY CURVE TO USE  SHLDSP
C                      THAT IS IF                                        SHLDSP
C                      INUSP=0     USE PREDICTED VALUES                  SHLDSP
C                      INUSP=1     USE BUILT-IN VALUES                   SHLDSP
C                      INUSP.GT.1 USE INPUT VALUES                       SHLDSP
C                                                                        SHLDSP
C     OUTPUT                                                             SHLDSP
C                                                                        SHLDSP
C         SPZ          CONFIGURATION CORRECTIONS AND SHIELDING ATTUENUATION SHLDSP
```

```
C          SPLT       A MATRIX OF SHIELDED SPECTRA
C       NOTE
C          USPL       A MATRIX OF UNSHIELDED SPECTRA WITH DOPPLER
C                     EFFECTS REMOVED GENERALLY PREDICTED BUT
C                     COULD BE INPUT OR MADE UP OF BUILT-IN VALUES
C
C
C       UNSHIELDED DIRECTIVITY CURVE    DATA
C
        COMMON/UNSHLD/USPLA(19),FSI(19),NUSPL,INUSP
        DIMENSION DUM(19),YCO(17),ZCO(17),PSIX(19),USPL(19,24),KIN(19),
       *DLTSPL(24,17),APY(10,17),APZ(10,17),SPLT(24,17),SPZ(24,17),FJ(24),
       *SLDIST(10),DOPSF(17),BCF(24),PSI(17,10)
C
        DATA NPSI,MAXPSI/17,19/
        DATA FJ/1.,2.,3.,4.,5.,6.,7.,8.,9.,10.,11.,12.,13.,
       *14.,15.,16.,17.,18.,19.,20.,21.,22.,23.,24./
C
C       ZERO OUT MATRIX AND SET VARIABLES
C
        CALL ZERO(USPL,408)
        EN=4.
        IF(ITYPE.EQ.3.AND.ISW3.EQ.2)EN=2.
C
C       BANDWIDTH IN 1/3 OCTAVES
C
        BW=1.
        IF(ISPTRM.NE.0)BW=3.
        DISTX=SLDIST(IOBS)
C
C        STORE COORDINATES FOR EACH OBSERVER TO TRANSFER TO SHATTN
        DO 50 K=1,NPSI
        YCO(K)=APY(IOBS,K)
     50 ZCO(K)=APZ(IOBS,K)
C
C       TEST FOR WHICH DIRECTIVITY CURVE TO USE
C
        IF(INUSP.NE.0)GO TO 450
C
C       USE PREDICTED VALUES REMOVING DOPPLER EFFECT
C
        NPSIX=NPSI
        DO 100 K=1,NPSIX
        DELTAL=10.*ALOG10(DOPSF(K))
        DELTAB=DELTAL/BW
        PSIX(K)=PSI(K,IOBS)
        DO 100 J=1,NCF
        FJDB= FJ(J)   -DELTAB
        SPLJ=TBLU1(FJDB,FJ,SPLT(1,K),1,NCF)
        USPL(K,J)=SPLJ+EN*DELTAL
    100 CONTINUE
C
C       SORT THE DIRECTIVITY ANGLE IN MONOTONICALLY ASCENDING
C       ORDER AND CORRESPONDINGLY ADJUST THE PREDICTED UNSHIELDED SPL
C
        CALL SHELL(PSIX,KIN,NPSIX)
        DO 200 J=1,NCF
```

```
      CALL SHELXH(USPL(1,J), KIN, DLM, NPSIX)
  200 CONTINUE
C
C     ADJUST FOR EQUAL DIRECTIVITY ANGLES
C
      MPSI=NPSIX-1
      DO 300 ISI=2,MPSI
      IF(PSIX(ISI-1).NE.PSIX(ISI))GO TO 300
      PSIX(ISI)=PSIX(ISI)+1.E-3*(PSIX(ISI+1)-PSIX(ISI))
  300 CONTINUE
      IF(PSIX(MPSI).NE.PSIX(NPSI))GO TO 650
      PSIX(MPSI)=PSIX(MPSI)-1.E-3*(PSIX(MPSI)-PSIX(MPSI-1))
      GO TO 650
C
C     BUILD MATRIX WITH EITHER BUILT-IN VALUES OR INPUT VALUES
C
  450 NPSIX=NUSPL
      DO 500 K=1,NPSIX
  500 PSIX(K)=PSI(K)
      DO 600 J=1,NCF
      DO 600 K=1,NPSIX
  600 USPL(K,J)=USPLA(K)
C
C     CALC.BARE ENGINE SPL USING PREDICTED SPL
C
  650 DO 700 K=1,NPSI
      DO 700 J=1,NCF
  700 SPLT(J,K)=SPLT(J,K)+SPZ(J,K)
C
C     ENTER PACKAGE TO CALCULATE ATTENUATION
C     DUE TO WING SHIELDING DLTSPL(MAX 24,17). THIS MATRIX
C     INCLUDES FOR EACH OBSERVER POSITION GREATER THAN 0. THE SUMMED
C     EFFECTS OF BOTH STARBOARD AND PORT NOISE SOURCE COMPONENT OVER
C     THE DESIRED WING EDGES
C
      CALL SHATTN(AMACH,CZ,NCF,BCF,NPSIX,PSIX,MAXPSI,USPL,
     *ISPTRM,DISTX,YCO,ZCO,ALTR,NPSI,PSI,DELT3,ITYPE,DLTSPL)
C
C     DOPPLER SHIFT THE SHIELDING ATTENUATION,AND ADD TO
C     CONFIGURATION CORRECTION.  THE TOTAL ATTENUATION
C     IS THEN ADDED TO THE BARE ENGINE SPL TO GIVE THE
C     THE SHIELDED SPL
C
      DO 1000 K=1,NPSI
      DELTAL=10.*ALOG10(DOPSF(K))
      DELTAB=DELTAL/BW
      DO 1000 J=1,NCF
      FJDB= FJ(J)  +DELTAB
      DSPLJ=TBLU1(FJDB,FJ,DLTSPL(1,K),1,NCF)
      SPZ(J,K)=DSPLJ+SPZ(J,K)
      SPLT(J,K)=SPLT(J,K)- SPZ(J,K)
 1000 CONTINUE
      RETURN
      END
```

```
      SUBROUTINE SIDPLT(VN,DIST,NP,NDIST,TITLE,NSD,NDIM)
C
C
C AUTHOR              K.D. JOHNSON
C PURPOSE             TO GENERATE PLOT OF 500 FOOT SIDELINE NOISE LEVEL
C                     VS. DISTANCE ALONG RUNWAY
C
C METHOD              SCALE TO UNITS/CM, DRAW AXIS AND PLOT CURVE OF
C                     CONNECTING POINTS
C
C INPUTS              VN          ARRAY OF NOISE LEVEL VALUES
C                     DIST        ARRAY OF CORRESPONDING DISTANCE VALUES
C                     NP          NUMBER OF POINTS TO BE PLOTTED
C
C INPUTS VIA COMMON
C                     SCALV       USER SELECTED SCALE, USED IF NON-ZERO
C                     YLENM       MAXIMUM LENGTH OF Y AXIS (GRAPH) (CM)
C                     XLENM       MAXIMUM LENGTH OF Y AXIS (GRAPH) (CM)
C                     AXUNIT      UNITS FOR DISTANCE
C                     NLABEL      UNITS FOR NOISE LEVEL
C
C DIMENSION FOR INPUT ARRAYS
C
      LOGICAL IWRITE
C 360
C     DIMENSION VN(NDIM,3),DIST(NDIM),NDIST(3),TITLE(18)
      DIMENSION VN(NDIM,3),DIST(NDIM),NDIST(3),TITLE( 8)
C
C 360
C     COMMON /PLT/ SCALV,YLENM,XLENM,CMPIN,SPACE(20),NXUNIT,NLABEL(2)
C
      COMMON /PLT/ SCALV,YLENM,XLENM,CMPIN,SPACE(8),NXUNIT,NLABEL
     1 ,SCALU,IWRITE
C
C 360
C     DIMENSION LABELX(11), LABELY(9)
      DIMENSION LABELX(5),LABELY(4)
C
C 360
C     DATA LABELX/44HNOISE LEVEL AT  XXXXAAAA SIDELINE - AAAAAAAA/
      DATA LABELX/50HNOISE LEVEL AT XXXX AAAA SIDELINE - AAAAAAAA
     * /
C     DATA LABELY /36HDISTANCE ALONG FLIGHT TRACK -        /
      DATA LABELY /40HDISTANCE ALONG FLIGHT TRACK -            /
      DATA BLANK/1H /
C
C DEFINE BORDERS IN CENTIMETERS
      SIDE=2.
      TOP=2.
      BOTTM=3.
C
C SET POINT SYMBOL
C
      ISYM=2
C
C FIND APPROPRIATE NOISE LEVEL SCALE AND LENGTH OF AXIS
C
```

```
      IF(IWRITE) GO TO 10
C 360
C     WRITE(6,1000) (NLABEL(I),I=1,2),NXUNIT,(NDIST(I),NXUNIT,I=1,NSD)
      WRITE(6,1000)  NLABEL          ,NXUNIT,(NDIST(I),NXUNIT,I=1,NSD)
 1000 FORMAT(1H1,54X,21HSIDELINE NOISE LEVELS,///31X,21HFLIGHT TRACK DIS
     *TANCE,21X,13HNOISE LEVEL (,A8,1H),/40X,A4,20X,3(A4,1X,A4,6X)//)
      DO 5 I=1,NP
      WRITE(6,1001) DIST(I),(VN(I,J),J=1,NSD)
 1001 FORMAT(30X,1PE15.3,9X,0PF15.1,2F15.1)
5     CONTINUE
10    XLEN=FLOAT(INT(XLENM-TOP-BOTTM))
C
C FIND LENGTH OF YAXIS, Y SCALE SAME AS CONTOUR PLOT
C
      YLEN=FLOAT(INT(YLENM-2.*SIDE))
      CALL SCALE(DIST,YLEN,NP,1)
      DELTAY=DIST(NP+2)
      YMIN=DIST(NP+1)
      DELTAY=SCALU
      IF  (YMIN .EQ. 0.)  GO TO 15
      YMIN  =  DELTAY * FLOAT(IFIX((YMIN - DELTAY) / DELTAY))
15    CONTINUE
      DO 200 KK=1,NSD
      CALL SCALE(VN(1,KK),XLEN,NP,1)
      DELTAX=VN(NP+2,KK)
      XMIN=VN(NP+1,KK)
      XMIN=FLOAT(IFIX((XMIN-DELTAX)/DELTAX))*DELTAX
C
C POSITION PLOTTER  ON PAGE
C
      CALL PLOT(0.,-10.,-3)
      YP=1./CMPIN
      CALL PLOT(0.,YP,-3)
      XP=SIDE/CMPIN
      YP=BOTTM/CMPIN
      CALL PLOT(XP,YP,-3)
C
C DRAW Y AXIS
      NC  =  36
C     LABELY(9)  =  NXUNIT
      CALL STRMOV(NXUNIT,1,4,LABELY,31)
      CALL CMAXIS(0.,0.,LABELY,-NC,YLEN,0.0,YMIN,DELTAY)
C
C DRAW X AXIS
      NC=44
C 360
C     LABELX(5)=NDIST(KK)
C     LABELX(6)=NXUNIT
C     DO 25 I=1,2
C25   LABELX(9+I)=NLABEL(I)
C
      CALL STRMOV(NXUNIT,1,4,LABELX,21)
      CALL STRMOV(NDIST(KK),1,4,LABELX,16)
      CALL STRMOV(NLABEL,1,8,LABELX,37)
      CALL CMAXIS(0.,0.,LABELX,NC,XLEN,90.,XMIN,DELTAX)
C
C PLOT POINTS
```

```
      DELTAX=DELTAX*CMPIN
      DELCM=DELTAY*CMPIN
      DISTM=.YLEN*DELTAY+YMIN
C
C GOTO FIRST POINT WITH PEN UP
C
      XP=(DIST(1)-YMIN)/DELCM
      YP=(VN(1,KK)-XMIN)/DELTAX
      CALL PLOT(XP,YP,3)
C
C PLOT CURVE AS SERIES OF CONNECTED SYMBOLS
C
      DO 100 I=1,NP
      XP= DIST(I)
      IF(XP.GT.DISTM)GO TO 105
      XP=(XP-YMIN)/DELCM
      YP=(VN(I,KK)-XMIN)/DELTAX
      CALL SYMBOL(XP,YP,.06,ISYM,0.0,-2)
100   CONTINUE
C
C  DRAW TITLE AT TOP OF PAGE
C
105   XP=(XLEN+1.)/CMPIN
C     I=18
      I=8
125   IF(TITLE(I).NE.BLANK) GO TO 130
      I=I-1
      IF(I.GT.0) GO TO 125
130    IF(I.EQ.0) GO TO 135
C     I=I*4
      I=I*10
      YP  =  .5 * (YLEN / CMPIN - .16 * FLOAT(I))
      CALL SYMBOL(YP,XP,.16,TITLE,0.0,I)
135   CONTINUE
C
C MOVE TO NEW PAGE
C
      XP=(YLEN+SIDE)/CMPIN+ 2.
      YP=-BOTTM/CMPIN
      CALL PLOT(XP,YP,-3)
200   CONTINUE
C
      RETURN
      END
```

```
      SUBROUTINE SORRTR(A,B,C,L,DEPNDT,DUM,K,ARG)                       SORRTR
      DIMENSION A(1),B(1),C(1),DEPNDT(1),K(1),DUM(1),ARG(1)             SORRTR
      INTEGER K                                                         SORRTR
C                                                                       SORRTR
C  IBM SYS360 + 370                                                     SORRTR
C     REAL*8 ARG, DT1, DT2, DT3                                         SORRTR
      EQUIVALENCE (T1,DT1), (T2,DT2), (T3,DT3)                          SORRTR
C                                                                       SORRTR
C  DETERMINE SCALE FACTORS FOR SINGLE PASS, THREE VARIABLE SORT USING   SORRTR
C  FOUR SIGNIFICANT DIGITS                                              SORRTR
      DT1  =  0.                                                        SORRTR
      DT2  =  0.                                                        SORRTR
      DT3  =  0.                                                        SORRTR
      FL  =  L                                                          SORRTR
      DO  10  I = 1,L                                                   SORRTR
      T1  =  T1 + ABS(A(I))                                             SORRTR
      T2  =  T2 + ABS(B(I))                                             SORRTR
      T3  =  T3 + ABS(C(I))                                             SORRTR
   10 CONTINUE                                                          SORRTR
      T1  =  10.**(INT(5.0 - ALOG10(T1/FL)))                            SORRTR
      T2  =  10.**(INT(-ALOG10(T2/FL)))                                 SORRTR
      T3  =  10.**(INT(-5.0 - ALOG10(T3/FL)))                           SORRTR
C                                                                       SORRTR
C  DEFINE NEW INDEPENDENT VARIABLE, ARG, CONTAINING SCALED VALUES OF    SORRTR
C  VARIABLES A, B, C.                                                   SORRTR
      DO  20  I = 1,L                                                   SORRTR
      ARG(I)  =  A(I)*DT1 + B(I)*DT2 + C(I)*DT3                         SORRTR
   20 CONTINUE                                                          SORRTR
      CALL SHELL(ARG,K,L)                                               SORRTR
      CALL SHELXH(DEPNDT,K,DUM,L)                                       SORRTR
      CALL SHELXH(A,K,DUM,L)                                            SORRTR
      CALL SHELXH(B,K,DUM,L)                                            SORRTR
      CALL SHELXH(C,K,DUM,L)                                            SORRTR
      RETURN                                                            SORRTR
      END                                                               SORRTR
```

```
      SUBROUTINE SN(X,Y,I1,I2,N)
      DIMENSION X(1),Y(1)
      NM1  =  N - 1
      DO 100 I=I1,I2
      IF  (NM1)  25, 25, 50
25    X(I)=Y(I)
      GO TO 100
50    Y(I)=X(I)
100   CONTINUE
      RETURN
      END
```

```
      SUBROUTINE SORTX(X,Y,N)
C
C       AUTHOR  D.G.DUNN
C
C       THIS ROUTINE SORTS POINTS (X,Y) WITH RESPECT TO
C       INDEPENDENT VARIABLE (X).  AFTER SORTING THE
C       (X) ARRAY WILL BE MONOTONIC AND ORDERED IN INCREASING
C        VALUE.
C
      DIMENSION X(1),Y(1)
      KK=N-1
      DO 2 K=1,KK
      KL=K+1
      DO 2 J=KL,N
      IF(X(J)-X(K))1,2,2
1     T=X(J)
      X(J)=X(K)
      X(K)=T
      T=Y(J)
      Y(J)=Y(K)
      Y(K)=T
2     CONTINUE
      RETURN
      END
```

```
      SUBROUTINE SPECAN
C
C     PURPOSE  EMPIRICAL PREDICTION OF THE SOUND PRESSURE LEVEL
C              FOR AN AUGMENTOR SLOT NOZZLE WITH JET FLAP
C
C     SUBROUTINE SPECAN DETERMINES THE VARIABLES TO CALCULATE
C     THE CHARACTERISTIC FREQUENCY AND THEN DEVELOPS ARRAYS OF
C     SPL SPECTRA FOR EACH FLIGHT PATH OBSERVER COMBINATION,
C     THE INPUT DATA TO THE SUBROUTINE IS PROVIDED THROUGH
C     LABELLED COMMON STATEMENTS,AND DATA STATEMENTS
C     INPUT      MO       AIRCRAFT MACH NO
C                TSO      STATIC TEMP. AT ALTITUDE ZO
C                GRAD     CLIMB GRADIENT(TAN(THETA)
C                P        PROPAGATION PATH DISTANCE (SOURCE TO OBSERVER)
C                X,Y,Z    AIRCRAFT COORDINATES RELATIVE TO OBSERVER
C                GAMA     RATIO OF SPECIFIC HEATS FOR EXHAUST
C                TT       TOTAL TEMPERATURE AT NOZZLE EXIT
C                NPR      NOZZLE PRESSURE RATIO
C                DELT     FLAP ANGLE RELATIVE TO HORIZON
C                AD       NOZZLE DISCHARGE AREA
C                DE       EFFECTIVE DIAMETER - HYDRAULIC DIAMETER
C                FRQ      ARRAY OF GEOMETRIC MEAN FREQUENCIES
C                         FOR THE SOUND PRESSURE LEVEL SPECTRUM
C                NFB      NO. OF FREQUENCY BANDS
C                NOBS      NO. OF SIDELINE OBSERVER POSITIONS
C
C     OUTPUT     SPL      COLS.  OF SOUND PRESSURE LEVEL SPECTRA
C                         FOR EACH POINT ON THE FLIGHT PATH SEGMENT
C                         FORMING AN ARRAY FOR EACH OBSERVER POSITION
C
      COMMON/AUGWNG/GAMA,TT,NPR,DELT,AD,DE,
     *  ICOR6,LIN6,NTF6,IMA6,LGM6,NWL6,ICP6,ILAY6,TF6(10),
     *  PCTA6(10),PLA6(10),ELCH6,ECH6,RIW6(10),TL6(10),CF6,FM6
      COMMON/GCOMON/NCF,NK,FRQ(24),TSPL(24,10,17),SPLT(24,17),
     1   BUF(25),RETA(17),SPL2(17),TGAGR(24),DCPSF(17)
      COMMON/GEOMO/Y(10,17),Z(10,17),P(10,17),CPND(10,17),
     * B1(10,17),B2(10,17),IDS(17,10),TPD(17,10),IRR(10,17)
     *,APP,TSO,RHP,APO,TC,RHO,CA,CZ,TSF(17,10),CCV
      COMMON/GPRAM/ALTP,ALTR,GRAD,ML,NOBS,SLDIST(10),NTENG,IUNIT,
     *     DUMXX(493),BCC,TCG,FLR,AALT,EFF
      COMMON/SUMSPL/SSPL(24,10,17)
      COMMON/PNLD/PSPL(17,20),EPNL(5,10),TEPNL(5,10)
      COMMON/ANGLE/PSI(17,10),PSIG(17,10),BETA(17,10)
      COMMON/HEAD/HIN(20),HOUT(20),CHIN(20)
      COMMON/GFREQ/CFREQ(24),UFREQ(25),FFREQ(24)
      COMMON/SWITCH/NTYPE,ITYPE,NENG,ICCF,IPRT(7),ICN(13),NLCPT
      COMMON/GCONVC/C(2,10),SLDISX(10)
      COMMON/TMSPL/SPZ(24,17),IB(2,3,13)
      COMMON/CRSPLS/DCB(17),PSCR(17),DFB(408),NPSCR
C
      DIMENSION XPSI(7),YBETA(4),ZAC(7,4),ZA1(7),ZA2(7,4),
     1XFIFO(20),SPLOA(20),OBSS(24)
      REAL MO,NPR,MJE
C
      DATA XPSI/100.,110.,120.,130.,140.,150.,160./
      DATA YBETA/0.,30.,60.,90./
      DATA ZAC/117.1,117.2,118.6,118.7,122.9,118.8,118.2,
```

```
     1          121.4,122.0,122.3,120.7,126.1,122.4,121.4,                 SPECAN
     2          120.4,122.3,124.1,123.8,127.6,123.4,119.8,                 SPECAN
     3          118.9,119.9,121.1,120.9,128.6,122.8,119.5/                 SPECAN
      DATA ZA1/15.7,19.3,29.5,34.3,25.3,21.1,20.5/                         SPECAN
      DATA ZA2/51.3,53.1,50.4,53.4,46.0,51.5,53.3,                         SPECAN
     1          52.2,52.5,50.7,52.3,46.2,46.3,45.4,                        SPECAN
     2          61.6,58.0,55.2,56.7,48.8,47.3,51.7,                        SPECAN
     3          63.8,64.8,64.9,61.7,48.3,49.5,51.8/                        SPECAN
      DATA XFIFO/-2.,-1.699,-1.398,-1.222,-1.046,-.757,-.699,-.602,        SPECAN
     * -.523,-.456,-.398,-.301,-.222,-.097,0.,.114,.176,.301,.519,1.0/     SPECAN
      DATA SPLOA/-31.,-25.,-19.5,-16.5,-13.9,-10.,-9.25,-9.,-9.,           SPECAN
     1 -9.25,-9.5,-10.35,-11.15,-12.85,-14.5,-17.,-18.75,-22.5,            SPECAN
     2-30.,-47.25/                                                         SPECAN
      ICN(6)=ICN(6)+1                                                      SPECAN
C                                                                          SPECAN
C                                                                          SPECAN
      DELTR=DELT*.01745                                                    SPECAN
C     ANGLE BETWEEN FLIGHT PATH AND FLAP ANGLE                             SPECAN
      ALFA =DELTR -ATAN(GRAD)                                              SPECAN
      CSAL=COS(ALFA)                                                       SPECAN
C     TOTAL TEMP.OF FREE STREAM REL. TO EXHAUST                            SPECAN
      TTO= TSO*(1.+.2*(MO*CSAL)**2)                                        SPECAN
      TRAT= TT/TTO                                                         SPECAN
      GAMM1=GAMA-1.                                                        SPECAN
      Q= NPR**(GAMM1/GAMA)                                                 SPECAN
C     STATIC TEMP.OF EXHAUST                                               SPECAN
      TS=TT/Q                                                              SPECAN
C     MACH NO OF JET EXHAUST                                               SPECAN
      MJE= SQRT(2./GAMM1*(Q-1.))                                           SPECAN
C     VEL REL TO NOZZLE OF JET EXHAUST                                     SPECAN
      VJE= MJE*SQRT(1716.5*GAMA*TS)                                        SPECAN
C     VEL(AIR)REL. TO NOZZLE                                               SPECAN
      VO=MO*49.02*SQRT(TSO)                                                SPECAN
C     VEL OF JET REL TO AMBIENT AIR                                        SPECAN
      VJR=SQRT(VJE*VJE-2.*VJE*VO*CSAL+VO*VO)                               SPECAN
C     CHARACTERISTIC FREQUENCY                                             SPECAN
      FO= VJR/DE/TRAT                                                      SPECAN
C     EVALUATE CONSTANTS OF FUNCTIONAL VALUES                              SPECAN
      C1=ALOG10(TRAT)                                                      SPECAN
      C2=ALOG10(NPR)                                                       SPECAN
      C3=10.*ALOG10(.188*AO)                                               SPECAN
C     TEST FOR 1/3 OCTAVE BAND FREQUENCY OR PREFERRED                      SPECAN
      TENL3=0.0                                                            SPECAN
      IF(NCF.EQ.8)TENL3=4.77                                               SPECAN
C     FIND OCTAVE BAND SPECTRUM SHAPE                                      SPECAN
   20 DO 50 NF=1,NCF                                                       SPECAN
      FIFO=FRQ(NF)/FO                                                      SPECAN
      AFIFO=ALOG10(FIFO)                                                   SPECAN
      OBSS(NF)=TBLU1(AFIFO,XFIFO,SPLOA,1,20)+TENL3                         SPECAN
   50 CONTINUE                                                             SPECAN
C                                                                          SPECAN
      CALL ANGLES(NOBS,DELTR)                                              SPECAN
      FBPF=0.3*FO                                                          SPECAN
      DO 300 I=1,NOBS                                                      SPECAN
      CALL LINCOR(SPZ(1,1),IMA6,LGM6,ELCH6,EDH6,AKL6,R1W6,TL6,             SPECAN
     * ILAY6,FM6,IDP6,PSI(1,I),NCF,FRC,PLA6,CF6,PCTA6,NTF6,TF6,DOPSF,      SPECAN
     * SPL2,ICOR6,IB(1,1,ITYPE),LIN6,FEFF)                                 SPECAN
```

```
      DO 200 J=1,17                                                     SPECAN
C     TABLE LOOK UP                                                     SPECAN
      A0=TBLU2(PSI(J,I),BETA(J,I),XPSI,YBETA,ZA0,1,1,7,4,7,4)           SPECAN
      A1=TBLU1(PSI(J,I),XPSI,ZA1,1,7)                                   SPECAN
      A2=TBLU2(PSI(J,I),BETA(J,I),XPSI,YBETA,ZA2,1,1,7,4,7,4)           SPECAN
C     OVERALL SOUND PRESSURE LEVEL                                      SPECAN
      OA=A0+A1*C1+A2*C2+C3                                              SPECAN
C     OBTAIN SOUND PRESSURE LEVEL SPECTRUM                              SPECAN
C                        SPECTRA FOR AUGMENTOR SLOT NOZZLE WITH JET FLAP SPECAN
      DO 100 NF=1,NCF                                                   SPECAN
      SPLT(NF,J)=OA+OBSS(NF)-SPZ(NF,J)                                  SPECAN
      SSPL(NF,I,J)=PWRSUM(SSPL(NF,I,J),SPLT(NF,J))                      SPECAN
C                                                                       SPECAN
  100 CONTINUE                                                          SPECAN
  200 CONTINUE                                                          SPECAN
      IF(IPRT(7).NE.7)GO TO 220                                         SPECAN
      CALL NOISO(IPRT(7),I,NK,10,CHIN,ILNIT,SLDISX(I),PFREQ,            SPECAN
     *     SPLT(1,1),NCF,ITYPE)                                         SPECAN
 220  CONTINUE                                                          SPECAN
      DO 240 NF=1,NCF                                                   SPECAN
      DO 240 J=1,17                                                     SPECAN
 240  SPLT(NF,J)=SPLT(NF,J)-TSPL(NF,I,J)                                SPECAN
      IF(IPRT(3).NE.3)GO TO 300                                         SPECAN
      CALL PNLSUB(SPLT(1,1),PSPL(1,I),TPC(1,I),EPNL(1,I),SPL2,          SPECAN
     *  TEPNL(1,I),NK,BCG,TCG,FLR,I,NCES,IRR(I,1))                      SPECAN
      CALL NOISO(IPRT(3),I,NK,12,CHIN,ILNIT,SLDISX(I),PFREQ,            SPECAN
     *     SPLT(1,1),NCF,ITYPE)                                         SPECAN
 300  CONTINUE                                                          SPECAN
      RETURN                                                            SPECAN
      END                                                               SPECAN
```

```
      SUBROUTINE SQUASH(A,M,B,L)                                        SQUASH
C       VALUES MUST BE MONOTONICALLY INCREASING IN THE A ARRAY          SQUASH
C       M MUST BE GREATER THAN ONE                                      SQUASH
C       A = INPUT ARRAY                                                 SQUASH
C       M = LENGTH OF INPUT ARRAY                                       SQUASH
C       B = THE RESULTANT ARRAY OF DISTINCT VALUES WHICH CAN            SQUASH
C           BE PLACED IN THE A ARRAY IF CORE SIZE IS OF CONCERN         SQUASH
C       L = THE NUMBER OF DISTINCT VALUES IN B                          SQUASH
      DIMENSION A(1),B(1)                                               SQUASH
      J=1                                                               SQUASH
      B(1)=A(1)                                                         SQUASH
      DO  1000  I=2,M                                                   SQUASH
      IF ( A(I) .EQ. A(I-1)) GO TO  1000                                SQUASH
      IF (A(I) .LT. B(J)) GO TO  1010                                   SQUASH
      J=J+1                                                             SQUASH
      B(J)=A(I)                                                         SQUASH
 1000 CONTINUE                                                          SQUASH
 1010 CONTINUE                                                          SQUASH
      L=J                                                               SQUASH
      RETURN                                                            SQUASH
      END                                                               SQUASH
```

```
      SUBROUTINE SWITCH(NEPR, NL, NLRO, NALFA, AARRAY, BARRAY)           SWITCH
C                                                                        SWITCH
C  SWITCH CHANGES NL  =  F(LRO, ALPHA, EPR) INTO A SET OF FUNCTIONS...   SWITCH
C               LOG10(RO)  =  F(EPR, ALPHA) FOR EACH DESIRED CONTOUR     SWITCH
C  INDICATED BY THE ARRAY ANL(J).                                        SWITCH
C     NEPR      NUMBER OF EPR VALUES IN AEPR                             SWITCH
C     NLRO      NUMBER OF LRO VALUES IN ALRO                             SWITCH
C     NALFA     NUMBER OF ALPHA VALUES IN AALFA                          SWITCH
C     NL        NUMBER OF VALUES OF NL IN ANL                            SWITCH
C     ANL       ARRAY OF VALUES OF SPECIFIC NOISE CONTOURS               SWITCH
C     AALFA     ARRAY OF VALUES OF ALPHA                                 SWITCH
C     ALRO      ARRAY OF VALUES OF LOG RO                                SWITCH
C     AEPR      ARRAY OF VALUES OF EPR                                   SWITCH
C    AARRAY  ...  NOISE LEVELS FOR F(LRO, ALPHA, EPR)                    SWITCH
C    BARRAY  ...  LOG10(RO)     FOR F(EPR, ALPHA) AT EACH ANL(J)         SWITCH
      DIMENSION AARRAY(NLRO,NALFA,NEPR)                                  SWITCH
      DIMENSION BARRAY(NEPR,NALFA,NL)                                    SWITCH
      COMMON/CONTNT/AEPR(6),ALRO(9),AALFA(6)                             SWITCH
      COMMON/LEVELS/ANL(5)                                               SWITCH
C                                                                        SWITCH
C                                                                        SWITCH
      DO  1010  L=1,NEPR                                                 SWITCH
      DO  1010  M=1,NALFA                                                SWITCH
      DO  1010  J=1,NL                                                   SWITCH
      BARRAY(L,M,J)  =  TBLU1(ANL(J), AARRAY(1,M,L), ALRO, 1, NLRO)      SWITCH
 1010 CONTINUE                                                           SWITCH
C                                                                        SWITCH
C  BARRAY REPRESENTS  LOG10(RO) = F(EPR, ALPHA)  FOR EACH ANL(J)         SWITCH
      RETURN                                                             SWITCH
      END                                                                SWITCH
```

```
      FUNCTION TBLU1(XX,X,Y,MD,N)
C     S00934   TBLU1    PS-473      LU, PAUL         661013 7094   6600
C                       TABLE LOOKUP AND INTERPOLATION
      DIMENSION Y(1),X(1)
      INTEGER SEARCH
C
C     X ALWAYS INCREASING (OR DECREASING)
      ND = MD
      IF(SEARCH(XX,X,ND,N,I) .EQ. 0)GO TO 43
C     RETURN EXACT VALUE
      TBLU1 = Y(I)
      GO TO 51
C      INTERPOLATE
   43 TBLU1 = TERP1(XX,X,Y,ND,I)
   51 RETURN
      END
```

```
      FUNCTION TBLU2(XX,YY,X,Y,F2,MDX,MDY,NLX,NLY,NFX,NFY)
C     S00936    TBLU2     PS-473     LL, PAUL           661013 7094   6600
C              TABLE LOOKUP AND INTERPOLATE -- 2 INDEPENDENT VARIABLES
      DIMENSION F2(NFX,NFY),S(20),X(1),Y(1)
      INTEGER SEARCH
C     FIND POSITION IN X AND Y
      NDX = MDX
      NDY = MDY
      I1 = SEARCH(XX,X,NDX,NLX,I)
      I1 = I1 + I1 + 1 + SEARCH (YY,Y,NDY,NLY,J)
C     100--NEITHER EXACT, 50--Y EXACT, 60--X EXACT, 10--BOTH EXACT
      GO TO(100,50,60,10),I1
C     X IS EXACT MOVE THAT ROW TO S AND USE TERP1
C     A MAX OF 19 MAY BE USED  IN SOME CASES FOR NDY
   60 IX = MIN0(NDY,19)
      I2 = IX + J
      DO 1 I1 = J, I2
      IT = I1 - J
    1 S(IT+1) = F2(I,I1)
      TBLU2 = TERP1(YY,Y(J),S,IX,1)
      GO TO 1000
C     Y IS EXACT USE TERP1
   50 TBLU2 = TERP1(XX,X,F2(1,J),NDX,1)
      GO TO 1000
  100 TBLU2 = TERP2(XX,YY,X,Y,F2,NDX,NDY,NFX,NFY,I,J)
 1000 RETURN
   10 TBLU2 = F2(I,J)
      GO TO 1000
      END
```

```
      FUNCTION TBLU3(X1,Y1,Z1,X,Y,Z,F3,MDX,MDY,MDZ,NLX,NLY,NLZ,          TBLU3
     1             NFX,NFY,NFZ)                                          TBLU3
C                         TABLE LOOKUP AND INTERPOLATION                 TBLU3
C     S00938    TBLU3    PS-473     LL, PAUL          661013 7094   6600 TBLU3
      DIMENSION X(1), Y(1), Z(1), F3(NFX,NFY,NFZ), S(20,20)              TBLU3
      INTEGER SEARCH                                                     TBLU3
      NDX = MDX                                                          TBLU3
      NDY = MDY                                                          TBLU3
      NDZ = MDZ                                                          TBLU3
C     FIND POSITION OF X, Y, AND Z IN TABLES                             TBLU3
      IX = SEARCH(X1,X,NDX,NLX,I)                                        TBLU3
      IY = SEARCH(Y1,Y,NDY,NLY,J)                                        TBLU3
      IZ = SEARCH(Z1,Z,NDZ,NLZ,K)                                        TBLU3
C     CONSIDER IX BIT PATTERN                                            TBLU3
C         BIT 0 SET--X EXACT, BIT 1--Y EXACT, BIT 2--Z EXACT             TBLU3
      IX = IX + IY + IY + IZ*4 +1                                        TBLU3
      GO TO (11,1,2,21,22,15,20,12),IX                                   TBLU3
C     NONE EXACT                                                         TBLU3
   11 TBLU3 = TERP3(X1,Y1,Z1,X,Y,Z,F3,NDX,NDY,NDZ,NFX,NFY,NFZ,I,J,K)     TBLU3
 1000 RETURN                                                             TBLU3
C     ALL EXACT--STRAIGHT TABLE LOOKUP                                   TBLU3
   12 TBLU3 = F3(I,J,K)                                                  TBLU3
      GO TO 1000                                                         TBLU3
C     Y AND Z ARE EXACT                                                  TBLU3
   20 TBLU3 = TERP1(X1,X,F3(1,J,K),NDX,I)                                TBLU3
      GO TO 1000                                                         TBLU3
C     X AND Y ARE EXACT -- MOVE F3(I,J,*)                                TBLU3
   21 IX = MIN0(19,NDZ)                                                  TBLU3
      IY = K + IX                                                        TBLU3
      DO 14 IZ = K, IY                                                   TBLU3
      IXA = IZ - K + 1                                                   TBLU3
   14 S(IXA,1) = F3(I,J,IZ)                                              TBLU3
      TBLU3 = TERP1(Z1,Z(K),S,IX,1)                                      TBLU3
      GO TO 1000                                                         TBLU3
C     X AND Z ARE EXACT -- MOVE F3(I,*,K)                                TBLU3
   15 IX = MIN0(NDY,19)                                                  TBLU3
      IY = J + IX                                                        TBLU3
      DO 16 IZ = J, IY                                                   TBLU3
      IXA = IZ - J + 1                                                   TBLU3
   16 S(IXA,1) = F3(I,IZ,K)                                              TBLU3
      TBLU3 = TERP1(Y1,Y(J),S,IX,1)                                      TBLU3
      GO TO 1000                                                         TBLU3
C     Z IS EXACT                                                         TBLU3
   22 TBLU3 = TERP2(X1,Y1,X,Y,F3(1,1,K),NDX,NDY,NFX,NFY,I,J)             TBLU3
      GO TO 1000                                                         TBLU3
C     X IS EXACT -- MOVE F3(I,*,*)                                       TBLU3
    1 IX = MIN0(NDY,19)                                                  TBLU3
      IY = MIN0(NDZ,19)                                                  TBLU3
      IJ = J + IX                                                        TBLU3
      IK = K + IY                                                        TBLU3
      DO 3 IZ = J, IJ                                                    TBLU3
      DO 3 II = K, IK                                                    TBLU3
      IXA = IZ - J + 1                                                   TBLU3
      IXB = II - K + 1                                                   TBLU3
    3 S(IXA,IXB) = F3(I,IZ,II)                                           TBLU3
      TBLU3 = TERP2(Y1,Z1,Y(J),Z(K),S,IX,IY,20,20,1,1)                   TBLU3
      GO TO 1000                                                         TBLU3
```

```
C     Y IS EXACT -- MOVE F3(*,J,*)
    2 IX = MINO(19,NDX)
      IZ = MINO(19,NDZ)
      II = I + IX
      IK = K + IZ
      DO 4 JI = I, II
      DO 4 JK = K, IK
      IXA = JI - I + 1
      IXB = JK - K + 1
    4 S(IXA,IXB) = F3(JI,J,JK)
      TBLU3 = TERP2(X1,Z1,X(I),Z(K),S,NDX,NDZ,20,20,1,1)
      GO TO 1000
      END
```

```
      SUBROUTINE TEE227(IMODE,NLN)                                      TEE227
C     PROGRAM TEE227A(INPUT,OUTPUT,TAPE5 INPUT,TAPE6 OUTPUT)            TEE227
C     THIS PROGRAM HAS BEEN GENERATED AS A MEANS OF                     TEE227
C     CIRCUMVENTING THE NEED FOR INPUT TO TEE227 WHICH IS TO            TEE227
C   BE RUN UNDER CONTROL OF A REAL TIME SIMULATOR ON                    TEE227
C     THE SIGMA 7.                                                      TEE227
C     THE 4 NUMBERS REPRESENTED ON EACH LINE OF THE DATA                TEE227
C     STATEMENT ARE THE OUTPUT OF NOISE LEVEL, ENGINE PRESSURE          TEE227
C     RATIO, ELEVATION ANGLE, LOGIC OF RANGE, GENERATED BY              TEE227
C     THE NOISE PREDICTION PROGRAM, TEE187 PER INPUT CASE               TEE227
C     AND PLACED ON FILE TAPE20, WHICH HAVE BEEN PROCESSED              TEE227
C     BY THE TEE187C POST-PROCESSOR.  THE POST-PROCESSOR                TEE227
C     INCORPORATES THIS DATA DURING THE GENERATION OF THE               TEE227
C     MAIN PROGRAM OF TEE227, THE NOISE CONTOUR PROGRAM                 TEE227
C     WHICH THE POST-PROCESSOR HAS OUTPUT IN SOURCE CODING ON           TEE227
C     FILE TAPE22                                                       TEE227
      COMMON/COUNT/NEPR,   NL                                           TEE227
      COMMON/CONTNT/AEPR(6),ALRO(9),AALFA(6)                            TEE227
      DIMENSION A10(72)                                                 TEE227
      EQUIVALENCE (DATN(   1),A10(1))                                   TEE227
      DIMENSION A11(72)                                                 TEE227
      EQUIVALENCE (DATN(  73),A11(1))                                   TEE227
      DIMENSION A12(72)                                                 TEE227
      EQUIVALENCE (DATN( 145),A12(1))                                   TEE227
      DIMENSION A13(72)                                                 TEE227
      EQUIVALENCE (DATN( 217),A13(1))                                   TEE227
      DIMENSION A14(72)                                                 TEE227
      EQUIVALENCE (DATN( 289),A14(1))                                   TEE227
      DIMENSION A15(72)                                                 TEE227
      EQUIVALENCE (DATN( 361),A15(1))                                   TEE227
      DIMENSION A16(72)                                                 TEE227
      EQUIVALENCE (DATN( 433),A16(1))                                   TEE227
      DIMENSION A17(72)                                                 TEE227
      EQUIVALENCE (DATN( 505),A17(1))                                   TEE227
      DIMENSION A18(72)                                                 TEE227
      EQUIVALENCE (DATN( 577),A18(1))                                   TEE227
      DIMENSION A19(72)                                                 TEE227
      EQUIVALENCE (DATN( 649),A19(1))                                   TEE227
      DIMENSION A20(72)                                                 TEE227
      EQUIVALENCE (DATN( 721),A20(1))                                   TEE227
      DIMENSION A21(72)                                                 TEE227
      EQUIVALENCE (DATN( 793),A21(1))                                   TEE227
      DIMENSION A22(72)                                                 TEE227
      EQUIVALENCE (DATN( 865),A22(1))                                   TEE227
      DIMENSION A23(72)                                                 TEE227
      EQUIVALENCE (DATN( 937),A23(1))                                   TEE227
      DIMENSION A24(72)                                                 TEE227
      EQUIVALENCE (DATN(1009),A24(1))                                   TEE227
      DIMENSION A25(72)                                                 TEE227
      EQUIVALENCE (DATN(1081),A25(1))                                   TEE227
      DIMENSION A26(72)                                                 TEE227
      EQUIVALENCE (DATN(1153),A26(1))                                   TEE227
      DIMENSION A27(72)                                                 TEE227
      EQUIVALENCE (DATN(1225),A27(1))                                   TEE227
      DIMENSION DATN(1296)                                              TEE227
      DIMENSION D1(324),D2(324),D3(324),D4(324)                         TEE227
      DATA A10 /                                                        TEE227
```

```
     1     1.125E 02,  2.000E 00,  7.181E 00,  2.301E 00,       TEE227    59
     2     9.530E 01,  1.800E 00,  1.448E 01,  3.204E 00,       TEE227    60
     3     1.101E 02,  1.600E 00,  7.181E 00,  2.000E 00,       TEE227    61
     4     1.116E 02,  1.600E 00,  1.448E 01,  2.000E 00,       TEE227    62
     5     9.341E 01,  1.200E 00,  9.000E 01,  2.301E 00,       TEE227    63
     6     6.268E 01,  1.200E 00,  4.500E 01,  3.806E 00,       TEE227    64
     7     3.386E 01,  1.000E 00,  0.0      ,  4.107E 00,       TEE227    65
     8     1.137E 02,  1.600E 00,  3.000E 01,  2.000E 00,       TEE227    66
     9     7.348E 01,  1.600E 00,  0.0      ,  3.806E 00,       TEE227    67
     *     1.110E 02,  1.600E 00,  4.500E 01,  2.301E 00,       TEE227    68
     *     7.934E 01,  1.200E 00,  3.000E 01,  2.903E 00,       TEE227    69
     *     4.695E 01,  1.000E 00,  3.000E 01,  3.806E 00,       TEE227    70
     *     8.988E 01,  2.000E 00,  9.000E 01,  3.806E 00,       TEE227    71
     *     8.140E 01,  1.000E 00,  4.500E 01,  2.000E 00,       TEE227    72
     *     1.021E 02,  1.800E 00,  0.0      ,  2.602E 00,       TEE227    73
     *     8.449E 01,  1.600E 00,  1.448E 01,  3.505E 00,       TEE227    74
     *     1.186E 02,  2.000E 00,  7.181E 00,  1.699E 00,       TEE227    75
     *     3.988E 01,  1.000E 00,  0.0      ,  3.806E 00/       TEE227    76
      DATA A11 /                                                TEE227    77
     1     9.136E 01,  1.800E 00,  3.000E 01,  3.505E 00,       TEE227    78
     2     9.270E 01,  1.800E 00,  4.500E 01,  3.505E 00,       TEE227    79
     3     1.033E 02,  1.800E 00,  3.000E 01,  2.903E 00,       TEE227    80
     4     9.737E 01,  1.800E 00,  3.000E 01,  3.204E 00,       TEE227    81
     5     1.047E 02,  1.800E 00,  4.500E 01,  2.903E 00,       TEE227    82
     6     9.943E 01,  1.200E 00,  9.000E 01,  1.699E 00,       TEE227    83
     7     9.871E 01,  1.800E 00,  4.500E 01,  3.204E 00,       TEE227    84
     8     1.077E 02,  1.400E 00,  3.000E 01,  1.699E 00,       TEE227    85
     9     1.003E 02,  1.800E 00,  9.000E 01,  3.204E 00,       TEE227    86
     *     1.140E 02,  2.000E 00,  1.448E 01,  2.301E 00,       TEE227    87
     *     9.859E 01,  1.400E 00,  0.0      ,  2.000E 00,       TEE227    88
     *     8.006E 01,  1.000E 00,  3.000E 01,  2.000E 00,       TEE227    89
     *     9.897E 01,  2.000E 00,  3.000E 01,  3.204E 00,       TEE227    90
     *     1.003E 02,  2.000E 00,  4.500E 01,  3.204E 00,       TEE227    91
     *     1.019E 02,  2.000E 00,  9.000E 01,  3.204E 00,       TEE227    92
     *     1.056E 02,  1.800E 00,  7.181E 00,  2.602E 00,       TEE227    93
     *     8.003E 01,  1.000E 00,  1.448E 01,  1.699E 00,       TEE227    94
     *     8.790E 01,  1.600E 00,  4.500E 01,  3.505E 00/       TEE227    95
      DATA A12 /                                                TEE227    96
     1     1.200E 02,  2.000E 00,  1.448E 01,  1.699E 00,       TEE227    97
     2     7.503E 01,  1.000E 00,  0.0      ,  1.699E 00,       TEE227    98
     3     8.181E 01,  1.800E 00,  7.181E 00,  3.806E 00,       TEE227    99
     4     7.857E 01,  1.000E 00,  7.181E 00,  1.699E 00,       TEE227   100
     5     8.695E 01,  1.200E 00,  7.181E 00,  2.301E 00,       TEE227   101
     6     7.990E 01,  1.400E 00,  4.500E 01,  3.505E 00,       TEE227   102
     7     9.190E 01,  2.000E 00,  0.0      ,  3.204E 00,       TEE227   103
     8     8.328E 01,  1.800E 00,  1.448E 01,  3.806E 00,       TEE227   104
     9     8.068E 01,  1.200E 00,  4.500E 01,  2.903E 00,       TEE227   105
     *     9.430E 01,  1.400E 00,  1.448E 01,  2.602E 00,       TEE227   106
     *     8.299E 01,  1.000E 00,  9.000E 01,  2.000E 00,       TEE227   107
     *     8.930E 01,  1.400E 00,  0.0      ,  2.602E 00,       TEE227   108
     *     9.147E 01,  1.600E 00,  0.0      ,  2.903E 00,       TEE227   109
     *     9.501E 01,  1.600E 00,  7.181E 00,  2.903E 00,       TEE227   110
     *     8.810E 01,  1.200E 00,  9.000E 01,  2.602E 00,       TEE227   111
     *     1.017E 02,  1.400E 00,  3.000E 01,  2.301E 00,       TEE227   112
     *     1.030E 02,  1.400E 00,  4.500E 01,  2.301E 00,       TEE227   113
     *     5.179E 01,  1.200E 00,  7.181E 00,  4.107E 00/       TEE227   114
      DATA A13 /                                                TEE227   115
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     1     1.150E 02,     2.000E 00,     C.0       ,     1.699E 00,          TEE227  116
     2     1.170E 02,     1.800E 00,     7.181E 00,     1.699E 00,          TEE227  117
     3     5.533E 01,     1.200E 00,     3.000E 01,     4.107E 00,          TEE227  118
     4     6.529E 01,     1.200E 00,     1.448E 01,     3.505E 00,          TEE227  119
     5     9.048E 01,     1.200E 00,     3.000E 01,     2.301E 00,          TEE227  120
     6     9.182E 01,     1.200E 00,     4.500E 01,     2.301E 00,          TEE227  121
     7     1.063E 02,     1.800E 00,     9.000E 01,     2.903E 00,          TEE227  122
     8     9.030E 01,     1.800E 00,     C.0       ,     3.204E 00,          TEE227  123
     9     9.384E 01,     1.800E 00,     7.181E 00,     3.204E 00,          TEE227  124
     *     1.008E 02,     1.600E 00,     7.181E 00,     2.602E 00,          TEE227  125
     *     9.961E 01,     1.400E 00,     1.448E 01,     2.301E 00,          TEE227  126
     *     7.746E 01,     1.600E 00,     9.000E 01,     4.107E 00,          TEE227  127
     *     8.535E 01,     1.800E 00,     3.000E 01,     3.806E 00,          TEE227  128
     *     5.781E 01,     1.200E 00,     7.181E 00,     3.806E 00,          TEE227  129
     *     1.046E 02,     1.400E 00,     9.000E 01,     2.301E 00,          TEE227  130
     *     7.701E 01,     1.600E 00,     7.181E 00,     3.806E 00,          TEE227  131
     *     6.787E 01,     1.000E 00,     9.000E 01,     2.903E 00,          TEE227  132
     *     1.149E 02,     1.800E 00,     7.181E 00,     2.000E 00/          TEE227  133
      DATA A14 /                                                            TEE227  134
     1     7.848E 01,     1.600E 00,     1.448E 01,     3.806E 00,          TEE227  135
     2     5.544E 01,     1.000E 00,     7.181E 00,     3.204E 00,          TEE227  136
     3     1.023E 02,     1.600E 00,     1.448E 01,     2.602E 00,          TEE227  137
     4     1.044E 02,     1.600E 00,     3.000E 01,     2.602E 00,          TEE227  138
     5     6.723E 01,     1.000E 00,     7.181E 00,     2.602E 00,          TEE227  139
     6     1.061E 02,     1.600E 00,     7.181E 00,     2.301E 00,          TEE227  140
     7     1.134E 02,     1.800E 00,     C.0       ,     1.699E 00,          TEE227  141
     8     7.255E 01,     1.400E 00,     3.000E 01,     3.806E 00,          TEE227  142
     9     1.042E 02,     1.400E 00,     7.181E 00,     1.699E 00,          TEE227  143
     *     9.730E 01,     1.600E 00,     C.0       ,     2.602E 00,          TEE227  144
     *     9.429E 01,     1.800E 00,     9.000E 01,     3.505E 00,          TEE227  145
     *     7.828E 01,     1.800E 00,     C.0       ,     3.806E 00,          TEE227  146
     *     6.287E 01,     1.000E 00,     1.448E 01,     2.903E 00,          TEE227  147
     *     6.494E 01,     1.000E 00,     3.000E 01,     2.903E 00,          TEE227  148
     *     6.446E 01,     1.400E 00,     1.448E 01,     4.107E 00,          TEE227  149
     *     1.106E 02,     1.400E 00,     9.000E 01,     1.699E 00,          TEE227  150
     *     9.283E 01,     1.400E 00,     7.181E 00,     2.602E 00,          TEE227  151
     *     1.057E 02,     1.600E 00,     4.500E 01,     2.602E 00/          TEE227  152
      DATA A15 /                                                            TEE227  153
     1     1.073E 02,     1.600E 00,     9.000E 01,     2.602E 00,          TEE227  154
     2     5.666E 01,     1.200E 00,     4.500E 01,     4.107E 00,          TEE227  155
     3     5.946E 01,     1.400E 00,     C.0       ,     4.107E 00,          TEE227  156
     4     7.726E 01,     1.800E 00,     1.448E 01,     4.107E 00,          TEE227  157
     5     8.341E 01,     1.200E 00,     C.0       ,     2.301E 00,          TEE227  158
     6     4.488E 01,     1.000E 00,     1.448E 01,     3.806E 00,          TEE227  159
     7     9.544E 01,     2.000E 00,     7.181E 00,     3.204E 00,          TEE227  160
     8     9.690E 01,     2.000E 00,     1.448E 01,     3.204E 00,          TEE227  161
     9     9.841E 01,     1.200E 00,     1.448E 01,     2.301E 00,          TEE227  162
     *     1.230E 02,     2.000E 00,     9.000E 01,     2.000E 00,          TEE227  163
     *     1.090E 02,     2.000E 00,     C.0       ,     2.301E 00,          TEE227  164
     *     1.076E 02,     1.600E 00,     1.448E 01,     2.301E 00,          TEE227  165
     *     1.164E 02,     1.800E 00,     1.448E 01,     2.000E 00,          TEE227  166
     *     7.933E 01,     1.800E 00,     3.000E 01,     4.107E 00,          TEE227  167
     *     6.786E 01,     1.400E 00,     4.500E 01,     4.107E 00,          TEE227  168
     *     6.628E 01,     1.000E 00,     4.500E 01,     2.903E 00,          TEE227  169
     *     1.126E 02,     1.600E 00,     9.000E 01,     2.301E 00,          TEE227  170
     *     8.429E 01,     1.800E 00,     C.0       ,     3.505E 00/          TEE227  171
      DATA A16 /                                                            TEE227  172
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     1    1.124E 02,   1.800E 00,   1.448E 01,   2.301E 00,
     2    7.886E 01,   2.000E 00,   1.448E 01,   4.107E 00,
     3    8.093E 01,   2.000E 00,   3.000E 01,   4.107E 00,
     4    1.056E 02,   1.400E 00,   1.448E 01,   1.699E 00,
     5    9.443E 01,   1.200E 00,   1.448E 01,   1.699E 00,
     6    1.097E 02,   1.600E 00,   3.000E 01,   2.301E 00,
     7    1.006E 02,   1.400E 00,   0.0      ,   1.699E 00,
     8    1.185E 02,   1.800E 00,   3.000E 01,   2.000E 00,
     9    6.299E 01,   1.400E 00,   7.181E 00,   4.107E 00,
     *    8.066E 01,   1.800E 00,   4.500E 01,   4.107E 00,
     *    9.650E 01,   1.200E 00,   3.000E 01,   1.699E 00,
     *    9.784E 01,   1.200E 00,   4.500E 01,   1.699E 00,
     *    8.783E 01,   1.800E 00,   7.181E 00,   3.505E 00,
     *    8.929E 01,   1.800E 00,   1.448E 01,   3.505E 00,
     *    1.066E 02,   1.600E 00,   0.0      ,   2.000E 00,
     *    9.787E 01,   2.000E 00,   0.0      ,   2.903E 00,
     *    8.386E 01,   2.000E 00,   9.000E 01,   4.107E 00,
     *    5.690E 01,   1.000E 00,   1.448E 01,   3.204E 00/
      DATA A17 /
     1    6.946E 01,   1.400E 00,   9.000E 01,   4.107E 00,
     2    6.383E 01,   1.200E 00,   7.181E 00,   3.505E 00,
     3    6.901E 01,   1.400E 00,   7.181E 00,   3.806E 00,
     4    7.048E 01,   1.400E 00,   1.448E 01,   3.806E 00,
     5    5.897E 01,   1.000E 00,   3.000E 01,   3.204E 00,
     6    1.165E 02,   2.000E 00,   7.181E 00,   2.000E 00,
     7    4.589E 01,   1.000E 00,   0.0      ,   3.505E 00,
     8    7.810E 01,   1.200E 00,   0.0      ,   2.602E 00,
     9    8.163E 01,   1.200E 00,   7.181E 00,   2.602E 00,
     *    8.695E 01,   2.000E 00,   3.000E 01,   3.806E 00,
     *    7.548E 01,   1.400E 00,   9.000E 01,   3.806E 00,
     *    8.828E 01,   2.000E 00,   4.500E 01,   3.806E 00,
     *    6.901E 01,   1.000E 00,   0.0      ,   2.301E 00,
     *    1.221E 02,   2.000E 00,   3.000E 01,   1.699E 00,
     *    8.656E 01,   1.600E 00,   3.000E 01,   3.505E 00,
     *    1.150E 02,   1.600E 00,   4.500E 01,   2.000E 00,
     *    6.029E 01,   1.200E 00,   0.0      ,   3.505E 00,
     *    1.234E 02,   2.000E 00,   4.500E 01,   1.699E 00/
      DATA A18 /
     1    1.250E 02,   2.000E 00,   9.000E 01,   1.699E 00,
     2    1.214E 02,   1.800E 00,   9.000E 01,   2.000E 00,
     3    1.087E 02,   2.000E 00,   1.448E 01,   2.602E 00,
     4    8.226E 01,   1.800E 00,   9.000E 01,   4.107E 00,
     5    1.108E 02,   2.000E 00,   3.000E 01,   2.602E 00,
     6    6.630E 01,   1.200E 00,   0.0      ,   3.204E 00,
     7    6.984E 01,   1.200E 00,   7.181E 00,   3.204E 00,
     8    8.668E 01,   1.800E 00,   4.500E 01,   3.806E 00,
     9    8.828E 01,   1.800E 00,   9.000E 01,   3.806E 00,
     *    7.226E 01,   1.800E 00,   0.0      ,   4.107E 00,
     *    7.579E 01,   1.800E 00,   7.181E 00,   4.107E 00,
     *    1.218E 02,   1.800E 00,   4.500E 01,   1.699E 00,
     *    1.234E 02,   1.800E 00,   9.000E 01,   1.699E 00,
     *    1.184E 02,   1.800E 00,   1.448E 01,   1.699E 00,
     *    1.121E 02,   2.000E 00,   4.500E 01,   2.602E 00,
     *    1.137E 02,   2.000E 00,   9.000E 01,   2.602E 00,
     *    5.928E 01,   1.200E 00,   1.448E 01,   3.806E 00,
     *    9.770E 01,   1.400E 00,   4.500E 01,   2.602E 00/
      DATA A19 /
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     1      8.701E 01,     1.400E 00,     7.181E 00,     2.903E 00,           TEE227     230
     2      9.930E 01,     1.400E 00,     9.000E 01,     2.602E 00,           TEE227     231
     3      1.079E 02,     2.000E 00,     9.000E 01,     2.903E 00,           TEE227     232
     4      1.180E 02,     2.000E 00,     1.448E 01,     2.000E 00,           TEE227     233
     5      1.114E 02,     1.800E 00,     0.0      ,     2.000E 00,           TEE227     234
     6      7.581E 01,     1.200E 00,     7.181E 00,     2.903E 00,           TEE227     235
     7      1.021E 02,     1.400E 00,     7.181E 00,     2.000E 00,           TEE227     236
     8      7.386E 01,     2.000E 00,     0.0      ,     4.107E 00,           TEE227     237
     9      7.739E 01,     2.000E 00,     7.181E 00,     4.107E 00,           TEE227     238
     *      1.036E 02,     1.400E 00,     1.448E 01,     2.000E 00,           TEE227     239
     *      1.166E 02,     1.600E 00,     9.000E 01,     2.000E 00,           TEE227     240
     *      5.190E 01,     1.000E 00,     0.0      ,     3.204E 00,           TEE227     241
     *      4.341E 01,     1.000E 00,     7.181E 00,     3.806E 00,           TEE227     242
     *      1.086E 02,     1.400E 00,     9.000E 01,     2.000E 00,           TEE227     243
     *      1.015E 02,     1.600E 00,     9.000E 01,     2.903E 00,           TEE227     244
     *      8.550E 01,     1.600E 00,     0.0      ,     3.204E 00,           TEE227     245
     *      1.205E 02,     1.800E 00,     3.000E 01,     1.699E 00,           TEE227     246
     *      8.210E 01,     1.000E 00,     3.000E 01,     1.699E 00/           TEE227     247
      DATA A20 /                                                              TEE227     248
     1      8.188E 01,     1.600E 00,     4.500E 01,     3.806E 00,           TEE227     249
     2      8.348E 01,     1.600E 00,     9.000E 01,     3.806E 00,           TEE227     250
     3      7.227E 01,     1.200E 00,     0.0      ,     2.903E 00,           TEE227     251
     4      1.174E 02,     1.800E 00,     9.000E 01,     2.301E 00,           TEE227     252
     5      7.337E 01,     1.200E 00,     3.000E 01,     3.204E 00,           TEE227     253
     6      7.471E 01,     1.200E 00,     4.500E 01,     3.204E 00,           TEE227     254
     7      7.630E 01,     1.200E 00,     9.000E 01,     3.204E 00,           TEE227     255
     8      5.326E 01,     1.200E 00,     1.448E 01,     4.107E 00,           TEE227     256
     9      4.826E 01,     1.200E 00,     0.0      ,     4.107E 00,           TEE227     257
     *      8.344E 01,     1.000E 00,     4.500E 01,     1.699E 00,           TEE227     258
     *      8.503E 01,     1.000E 00,     9.000E 01,     1.699E 00,           TEE227     259
     *      8.847E 01,     1.400E 00,     1.448E 01,     2.903E 00,           TEE227     260
     *      1.057E 02,     1.400E 00,     3.000E 01,     2.000E 00,           TEE227     261
     *      7.255E 01,     1.000E 00,     7.181E 00,     2.301E 00,           TEE227     262
     *      1.070E 02,     1.400E 00,     4.500E 01,     2.000E 00,           TEE227     263
     *      8.943E 01,     2.000E 00,     7.181E 00,     3.505E 00,           TEE227     264
     *      4.226E 01,     1.000E 00,     4.500E 01,     4.107E 00,           TEE227     265
     *      4.386E 01,     1.000E 00,     9.000E 01,     4.107E 00/           TEE227     266
      DATA A21 /                                                              TEE227     267
     1      7.988E 01,     2.000E 00,     0.0      ,     3.806E 00,           TEE227     268
     2      1.145E 02,     1.800E 00,     3.000E 01,     2.301E 00,           TEE227     269
     3      7.401E 01,     1.000E 00,     1.448E 01,     2.301E 00,           TEE227     270
     4      7.750E 01,     1.400E 00,     0.0      ,     3.204E 00,           TEE227     271
     5      9.089E 01,     2.000E 00,     1.448E 01,     3.505E 00,           TEE227     272
     6      9.296E 01,     2.000E 00,     3.000E 01,     3.505E 00,           TEE227     273
     7      8.341E 01,     2.000E 00,     7.181E 00,     3.806E 00,           TEE227     274
     8      1.201E 02,     2.000E 00,     3.000E 01,     2.000E 00,           TEE227     275
     9      1.214E 02,     2.000E 00,     4.500E 01,     2.000E 00,           TEE227     276
     *      6.746E 01,     1.600E 00,     0.0      ,     4.107E 00,           TEE227     277
     *      9.430E 01,     2.000E 00,     4.500E 01,     3.505E 00,           TEE227     278
     *      9.589E 01,     2.000E 00,     9.000E 01,     3.505E 00,           TEE227     279
     *      1.157E 02,     1.600E 00,     3.000E 01,     1.699E 00,           TEE227     280
     *      1.174E 02,     2.000E 00,     4.500E 01,     2.301E 00,           TEE227     281
     *      8.055E 01,     1.600E 00,     3.000E 01,     3.806E 00,           TEE227     282
     *      6.736E 01,     1.200E 00,     3.000E 01,     3.505E 00,           TEE227     283
     *      9.391E 01,     1.600E 00,     4.500E 01,     3.204E 00,           TEE227     284
     *      9.550E 01,     1.600E 00,     9.000E 01,     3.204E 00/           TEE227     285
      DATA A22 /                                                              TEE227     286
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     1    9.054E 01,    1.400E 00,    3.000E 01,    2.903E 00,              TEE227  287
     2    8.750E 01,    1.400E 00,    9.000E 01,    3.204E 00,              TEE227  288
     3    9.647E 01,    1.600E 00,    1.448E 01,    2.903E 00,              TEE227  289
     4    7.149E 01,    1.400E 00,    0.0      ,    3.505E 00,              TEE227  290
     5    8.310E 01,    1.200E 00,    1.448E 01,    2.602E 00,              TEE227  291
     6    7.949E 01,    1.600E 00,    0.0      ,    3.505E 00,              TEE227  292
     7    7.130E 01,    1.200E 00,    1.448E 01,    3.204E 00,              TEE227  293
     8    1.092E 02,    1.800E 00,    3.000E 01,    2.602E 00,              TEE227  294
     9    8.104E 01,    1.400E 00,    7.181E 00,    3.204E 00,              TEE227  295
     *    6.870E 01,    1.000E 00,    1.448E 01,    2.602E 00,              TEE227  296
     *    7.210E 01,    1.000E 00,    4.500E 01,    2.602E 00,              TEE227  297
     *    7.370E 01,    1.000E 00,    9.000E 01,    2.602E 00,              TEE227  298
     *    5.787E 01,    1.000E 00,    0.0      ,    2.903E 00,              TEE227  299
     *    6.141E 01,    1.000E 00,    7.181E 00,    2.903E 00,              TEE227  300
     *    1.090E 02,    1.400E 00,    4.500E 01,    1.699E 00,              TEE227  301
     *    1.158E 02,    1.800E 00,    4.500E 01,    2.301E 00,              TEE227  302
     *    6.135E 01,    1.200E 00,    3.000E 01,    3.806E 00,              TEE227  303
     *    8.517E 01,    1.200E 00,    3.000E 01,    2.602E 00/              TEE227  304
      DATA A23 /                                                            TEE227  305
     1    1.105E 02,    1.800E 00,    4.500E 01,    2.602E 00,              TEE227  306
     2    1.121E 02,    1.800E 00,    9.000E 01,    2.602E 00,              TEE227  307
     3    9.854E 01,    1.600E 00,    3.000E 01,    2.903E 00,              TEE227  308
     4    7.503E 01,    1.400E 00,    7.181E 00,    3.505E 00,              TEE227  309
     5    1.190E 02,    2.000E 00,    9.000E 01,    2.301E 00,              TEE227  310
     6    5.296E 01,    1.000E 00,    3.000E 01,    3.505E 00,              TEE227  311
     7    3.739E 01,    1.000E 00,    7.181E 00,    4.107E 00,              TEE227  312
     8    9.188E 01,    1.400E 00,    4.500E 01,    2.903E 00,              TEE227  313
     9    5.430E 01,    1.000E 00,    4.500E 01,    3.505E 00,              TEE227  314
     *    7.077E 01,    1.000E 00,    3.000E 01,    2.602E 00,              TEE227  315
     *    9.461E 01,    1.400E 00,    0.0      ,    2.301E 00,              TEE227  316
     *    9.815E 01,    1.400E 00,    7.181E 00,    2.301E 00,              TEE227  317
     *    8.250E 01,    1.400E 00,    1.448E 01,    3.204E 00,              TEE227  318
     *    9.347E 01,    1.400E 00,    9.000E 01,    2.903E 00,              TEE227  319
     *    8.739E 01,    1.200E 00,    0.0      ,    2.000E 00,              TEE227  320
     *    9.093E 01,    1.200E 00,    7.181E 00,    2.000E 00,              TEE227  321
     *    7.299E 01,    1.000E 00,    0.0      ,    2.000E 00,              TEE227  322
     *    1.074E 02,    1.800E 00,    0.0      ,    2.301E 00/              TEE227  323
      DATA A24 /                                                            TEE227  324
     1    8.650E 01,    1.200E 00,    4.500E 01,    2.602E 00,              TEE227  325
     2    7.653E 01,    1.000E 00,    7.181E 00,    2.000E 00,              TEE227  326
     3    8.904E 01,    1.600E 00,    7.181E 00,    3.204E 00,              TEE227  327
     4    6.870E 01,    1.200E 00,    4.500E 01,    3.505E 00,              TEE227  328
     5    9.050E 01,    1.600E 00,    1.448E 01,    3.204E 00,              TEE227  329
     6    6.548E 01,    1.400E 00,    0.0      ,    3.806E 00,              TEE227  330
     7    1.014E 02,    2.000E 00,    7.181E 00,    2.903E 00,              TEE227  331
     8    1.086E 02,    1.600E 00,    0.0      ,    1.699E 00,              TEE227  332
     9    4.943E 01,    1.000E 00,    7.181E 00,    3.505E 00,              TEE227  333
     *    7.586E 01,    1.600E 00,    4.500E 01,    4.107E 00,              TEE227  334
     *    6.653E 01,    1.400E 00,    3.000E 01,    4.107E 00,              TEE227  335
     *    1.049E 02,    2.000E 00,    3.000E 01,    2.903E 00,              TEE227  336
     *    1.122E 02,    1.600E 00,    7.181E 00,    1.699E 00,              TEE227  337
     *    8.457E 01,    1.400E 00,    3.000E 01,    3.204E 00,              TEE227  338
     *    1.063E 02,    2.000E 00,    4.500E 01,    2.903E 00,              TEE227  339
     *    1.130E 02,    2.000E 00,    0.0      ,    2.000E 00,              TEE227  340
     *    4.828E 01,    1.000E 00,    4.500E 01,    3.806E 00,              TEE227  341
     *    4.988E 01,    1.000E 00,    9.000E 01,    3.806E 00/              TEE227  342
      DATA A25 /                                                            TEE227  343
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     1   1.029E 02,   2.000E 00,   1.448E 01,   2.903E 00,                  TEE227   344
     2   1.170E 02,   1.600E 00,   4.500E 01,   1.699E 00,                  TEE227   345
     3   9.988E 01,   1.600E 00,   4.500E 01,   2.903E 00,                  TEE227   346
     4   9.637E 01,   1.400E 00,   3.000E 01,   2.602E 00,                  TEE227   347
     5   7.029E 01,   1.200E 00,   9.000E 01,   3.505E 00,                  TEE227   348
     6   8.949E 01,   1.600E 00,   9.000E 01,   3.505E 00,                  TEE227   349
     7   1.186E 02,   1.600E 00,   9.000E 01,   1.699E 00,                  TEE227   350
     8   5.428E 01,   1.200E 00,   0.0      ,   3.806E 00,                  TEE227   351
     9   1.037E 02,   2.000E 00,   0.0      ,   2.602E 00,                  TEE227   352
     *   1.072E 02,   2.000E 00,   7.181E 00,   2.602E 00,                  TEE227   353
     *   3.886E 01,   1.000E 00,   1.448E 01,   4.107E 00,                  TEE227   354
     *   1.136E 02,   1.600E 00,   1.448E 01,   1.699E 00,                  TEE227   355
     *   7.649E 01,   1.400E 00,   1.448E 01,   3.505E 00,                  TEE227   356
     *   1.198E 02,   1.800E 00,   4.500E 01,   2.000E 00,                  TEE227   357
     *   6.428E 01,   1.200E 00,   9.000E 01,   3.806E 00,                  TEE227   358
     *   5.826E 01,   1.200E 00,   9.000E 01,   4.107E 00,                  TEE227   359
     *   4.093E 01,   1.000E 00,   3.000E 01,   4.107E 00,                  TEE227   360
     *   9.257E 01,   1.600E 00,   3.000E 01,   3.204E 00/                  TEE227   361
      DATA A26 /                                                            TEE227   362
     1   7.856E 01,   1.400E 00,   3.000E 01,   3.505E 00,                  TEE227   363
     2   8.149E 01,   1.400E 00,   9.000E 01,   3.505E 00,                  TEE227   364
     3   8.943E 01,   1.200E 00,   0.0      ,   1.699E 00,                  TEE227   365
     4   9.297E 01,   1.200E 00,   7.181E 00,   1.699E 00,                  TEE227   366
     5   7.727E 01,   1.200E 00,   1.448E 01,   2.903E 00,                  TEE227   367
     6   7.608E 01,   1.000E 00,   3.000E 01,   2.301E 00,                  TEE227   368
     7   7.742E 01,   1.000E 00,   4.500E 01,   2.301E 00,                  TEE227   369
     8   9.627E 01,   1.800E 00,   0.0      ,   2.903E 00,                  TEE227   370
     9   9.981E 01,   1.800E 00,   7.181E 00,   2.903E 00,                  TEE227   371
     *   1.071E 02,   1.800E 00,   1.448E 01,   2.602E 00,                  TEE227   372
     *   1.013E 02,   1.800E 00,   1.448E 01,   2.903E 00,                  TEE227   373
     *   5.589E 01,   1.000E 00,   9.000E 01,   3.505E 00,                  TEE227   374
     *   7.901E 01,   1.000E 00,   9.000E 01,   2.301E 00,                  TEE227   375
     *   6.370E 01,   1.000E 00,   0.0      ,   2.602E 00,                  TEE227   376
     *   8.488E 01,   2.000E 00,   1.448E 01,   3.806E 00,                  TEE227   377
     *   5.089E 01,   1.000E 00,   1.448E 01,   3.505E 00,                  TEE227   378
     *   1.109E 02,   1.800E 00,   7.181E 00,   2.301E 00,                  TEE227   379
     *   8.347E 01,   1.400E 00,   0.0      ,   2.903E 00/                  TEE227   380
      DATA A27 /                                                            TEE227   381
     1   8.591E 01,   1.400E 00,   4.500E 01,   3.204E 00,                  TEE227   382
     2   8.226E 01,   2.000E 00,   4.500E 01,   4.107E 00,                  TEE227   383
     3   1.161E 02,   2.000E 00,   3.000E 01,   2.301E 00,                  TEE227   384
     4   8.227E 01,   1.200E 00,   9.000E 01,   2.903E 00,                  TEE227   385
     5   7.388E 01,   1.400E 00,   4.500E 01,   3.806E 00,                  TEE227   386
     6   9.239E 01,   1.200E 00,   1.448E 01,   2.000E 00,                  TEE227   387
     7   7.099E 01,   1.600E 00,   7.181E 00,   4.107E 00,                  TEE227   388
     8   9.446E 01,   1.200E 00,   3.000E 01,   2.000E 00,                  TEE227   389
     9   9.580E 01,   1.200E 00,   4.500E 01,   2.000E 00,                  TEE227   390
     *   7.246E 01,   1.600E 00,   1.448E 01,   4.107E 00,                  TEE227   391
     *   8.303E 01,   1.600E 00,   7.181E 00,   3.505E 00,                  TEE227   392
     *   7.453E 01,   1.600E 00,   3.000E 01,   4.107E 00,                  TEE227   393
     *   7.799E 01,   1.000E 00,   1.448E 01,   2.000E 00,                  TEE227   394
     *   6.031E 01,   1.000E 00,   4.500E 01,   3.204E 00,                  TEE227   395
     *   9.739E 01,   1.200E 00,   9.000E 01,   2.000E 00,                  TEE227   396
     *   1.026E 02,   1.600E 00,   0.0      ,   2.301E 00,                  TEE227   397
     *   6.190E 01,   1.000E 00,   9.000E 01,   3.204E 00,                  TEE227   398
     *   8.589E 01,   2.000E 00,   0.0      ,   3.505E 00/                  TEE227   399
      N=1296                                                                TEE227   400
```

```
      N4=324
      CALL FTPRT(N,DATN,N4,D1,D2,D3,D4,IMODE,NLN)
      RETURN
      END
```

```
      FUNCTION TERP1(Z,X,Y,ND,I)                                        TERP1
C     SC0940   TERP1    PS-472      LL, PAUL          661013 7094   6600 TERP1
C                             LAGRANGIAN INTERPOLATION                  TERP1
      DIMENSION X(1), Y(1)                                              TERP1
      N = I + ND                                                        TERP1
C     INTERPOLATE FOR Y(Z)                                              TERP1
      TERP1 = 0.                                                        TERP1
      DO 50 J = I, N                                                    TERP1
      PX = 1.                                                           TERP1
      DO 42 K = I, N                                                    TERP1
      IF(K .EQ. J) GO TO 42                                             TERP1
      PX = (PX/(X(J) - X(K)))*(Z - X(K))                                TERP1
   42 CONTINUE                                                          TERP1
   50 TERP1 = TERP1 + PX*Y(J)                                           TERP1
   51 RETURN                                                            TERP1
      END                                                               TERP1
```

```
      FUNCTION TERP2(ZX,ZY,X,Y,F2,NX,NY,MX,MY,II,JJ)
C     S00941   TERP2    PS-472     LL, PAUL         661013 7094  6600
C              LAGRANGIAN INTERPOLATION -- 2 INDEPENDENT VARIABLES
      DIMENSION X(1), Y(1), F2(MX,MY)
      N = II + NX
      M = JJ + NY
      TERP2 = 0.
      DO 3 I = II, N
      PX = 1.
      DO 1 K = II, N
      IF(K .EQ. I)GO TO 1
      PX = (PX/(X(I) - X(K)))*(ZX - X(K))
    1 CONTINUE
      DO 3 J = JJ, M
      PY = 1.
      DO 2 K = JJ, M
      IF(K .EQ. J)GO TO 2
      PY = (PY/(Y(J) - Y(K)))*(ZY - Y(K))
    2 CONTINUE
    3 TERP2 = TERP2 + PY*PX*F2(I,J)
      RETURN
      END
```

```
      FUNCTION TERP3(X1,Y1,Z1,X,Y,Z,F3,NX,NY,NZ,MX,MY,MZ,I,J,K)
C     S00942   TERP3    PS-472      LU, PAUL           661013 7094   6600
C                     LAGRANGIAN INTERPOLATION -- 3 INDEPENDENT VARIABLES
      DIMENSION X(1), Y(1), Z(1), F3(MX,MY,MZ)
C     CALCULATE LOOP ENDS
      NI = I + NX
      NJ = J + NY
      NK = K + NZ
C     TRIPLE SUMMATION
      TERP3 = 0.
      DO 4 LI = I, NI
      PX = 1.
C     X PRODUCT
      DO 1 L = I, NI
      IF(L .EQ. LI)GO TO 1
      PX = (PX/(X(LI) - X(L)))*(X1 - X(L))
    1 CONTINUE
      DO 4 LJ = J, NJ
      PY = 1.
C     Y PRODUCT
      DO 2 L = J, NJ
      IF(L .EQ. LJ)GO TO 2
      PY = (PY/(Y(LJ) - Y(L)))*(Y1 - Y(L))
    2 CONTINUE
      DO 4 LK = K, NK
      PZ = 1.
C     Z PRODUCT
      DO 3 L = K, NK
      IF(L .EQ. LK)GO TO 3
      PZ = (PZ/(Z(LK) - Z(L)))*(Z1 - Z(L))
    3 CONTINUE
C     SUM
    4 TERP3 = TERP3 + PX*PY*PZ*F3(LI,LJ,LK)
      RETURN
      END
```

```
      SUBROUTINE TONCOR(SPL,CORR,FREQ,IRR)
C-----
C-----TONCOR   GRABLE,E.L.                   OCTOBER 1969
C-----   ABSTRACT     T O N C O R  IS A DRIVER FOR ACOUSTICS SUBROUTINES
C-----              THAT CALCULATE A TONE CORRECTION FROM A SOUND LEVEL
C-----              SPECTRUM.  THE SLOPE METHOD (DEFINED IN REF. 1) IS USED
C-----              TO FIND TONAL IRREGULARITIES, THEN THESE ARE APPLIED TO
C-----              THE ISO/FAA CURVES (ALSO IN REF. 1) TO FIND TONE COR-
C-----              RECTIONS.  THE MAXIMUM OF THESE IS RETURNED AS THE TONE
C-----              CORRECTION SOUGHT.
C-----     REFERENCE 1.    DEPARTMENT OF TRANSPORTATION, FEDERAL AVIATION
C-----                     REGULATIONS, TITLE 14, CHAPTER 1, PART 36    **
C-----                     NOISE STANDARDS- AIRCRAFT TYPE CERTIFICATION **
C-----                     FEDERAL AVIATION ADMINISTRATION, NOV. 3, 1969.
C-----
C-----     INPUT     SPL = AN ARRAY OF SOUND PRESSURE LEVELS CORRESPONDING
C-----                     TO 24 1/3-OCTAVE BANDS WITH CENTER FREQUENCY OF
C-----                     FIRST BAND AT 50 CPS.
C-----
C-----     OUTPUT    CORR= THE TONE CORRECTION FOR THE SPECTRUM.
C-----               FREQ= CENTER FREQUENCY OF THE BAND CORRESPONDING TO
C-----                     THE TONE CORRECTION.
C-----               IRR = THE BAND NUMBER CORRESPONDING TO THE TONE
C-----                     CORRECTION.
C-----
C-----     LOCAL VARIABLES
C-----       F = AN ARRAY OF TONAL IRREGULARITIES
C-----      FA = AN ARRAY OF CENTER FREQUENCIES
C-----      FC = AN ARRAY OF TONAL CORRECTIONS
C-----      N  - NUMBER OF FREQUENCY BANDS  (24)
C-----
      DIMENSION SPL(24,17),FA(24),F(24),FC(24),CORR(17)
      DATA  FA            / 50.,63.,80.,100.,125.,160.,200.,250.,315.,
     1400.,500.,630.,800.,1000.,1250.,1600.,2000.,2500.,3150.,4000.,
     25000.,6300.,8000.,10000./,N/24/
      DO 30 JJ=1,17
      CALL TONES3(SPL(1,JJ),F)
      CALL FAAISO(F,FA,N,FC)
      IRR = 1
      CORR(JJ)=0.
      DO 20 I=2,24
      IF (FC(I).LE.CORR(JJ)) GO TO 20
      IRR = I
      CORR(JJ) = FC(I)
   20 CONTINUE
      FREQ = FA(IRR)
 30   CONTINUE
      RETURN
      END
```

```
      SUBROUTINE TONES3(SPL,F)
C-----     GRABLE, E. L.      TONES3      700108
C-----     ABSTRACT  THE SLOPE METHOD OF TONE IDENTIFICATION AS PRESENTED
C-----               IN REFERENCE 1 IS USED TO FIND TONAL IRREGULARITIES
C-----               IN 24 ONE-THIRD OCTAVE BANDS.
C-----     REFERENCE 1.   DEPARTMENT OF TRANSPORTATION, FEDERAL AVIATION
C-----                    REGULATIONS, TITLE 14, CHAPTER 1, PART 36    **
C-----                    NOISE STANDARDS- AIRCRAFT TYPE CERTIFICATION **
C-----                    FEDERAL AVIATION ADMINISTRATION, NOV. 3, 1969.
C-----
C-----     INPUT* SPL ARRAY IS 24 ELEMENT ARRAY OF SOUND PRESSURE LEVELS
C-----                IN 24 ONE-THIRD OCTAVE BANDS (PREFERRED OCTAVES)
C-----     OUTPUT* F  ARRAY IS 24 ELEMENT ARRAY OF TONAL IRREGULARITIES.
C-----
C-----LOCAL VARIABLES                  MEANING
C-----                 S        FIRST ORDER SLOPES
C-----                 SPLP     AVERAGED  SOUND PRESSURE LEVELS
C-----
C
C
C     REVISIED ON MARCH 10, 1971 BY J. D. CRAIG
C
C       THE STEP 4 CALCULATIONS HAVE BEEN MODIFIED TO ALTER CALCULATION
C       OF SPLPRIME(23).  HERE-TO-FORE IF SPL(23) HAD BEEN CIRCLED AS
C       PER CONDITION 8 OF STEP 3, SPLPRIME(23) WAS NOT CALCULATED AS
C       THE AVERAGE OF SPL(22) AND SPL(24) AS PER PARAGRAPH 8 OF STEP
C       4.  THIS PARAGRAPH IS NOW SATISFIED.
C
      DIMENSION SPL(24),S(24),SPLP(24),F(24)
C-----      STEP ONE
      DO 20 I=4,24
      S(I) = SPL(I) - SPL(I-1)
   20 CONTINUE
C-----      STEPS TWO AND FOUR
      SPLP(3) = SPL(3)
      SPLP(4) = SPL(4)
      DO 50 I=5,24
      SPLP(I) = SPL(I)
      IF (ABS(S(I)-S(I-1)).LE.5.)  GO TO 50
C-----      STEPS THREE AND FOUR
      IF (S(I).LE.0.)    GO TO 40
      IF(I.LT.23.AND.
     *   (S(I).GT.S(I-1)))      SPLP(I) = (SPL(I-1)+SPL(I+1))*.5
      GO TO 50
   40 IF (S(I-1).GT.0.)         SPLP(I-1) = (SPL(I-2)+SPL(I))*.5
   50 CONTINUE
      SPLP(24) = SPL(24)
      IF(ABS(S(24)-S(23)).GT.5..AND.S(24).GT.AMAX1(0.,S(23)))
     *                          SPLP(24) = SPL(23) + S(23)
C-----      STEPS FIVE, SIX, SEVEN, AND EIGHT.
      F(1) = 0.
      F(2) = 0.
      F(3) = 0.
      DO 60 I=4,23
      F(I)  = SPL(I) - (SPLP(I-1) + SPLP(I) + SPLP(I+1) )/3.
   60 CONTINUE
      F(24) = SPL(24) - SPLP(24)
```

```
      DO 80 I=4,24
      IF (F(I).LT.0.)    F(I) = 0.
   80 CONTINUE
      RETURN
      END
```

```
      SUBROUTINE UNIFLW(AF,U,V,W,AMACH,ROP,THOP,TH,ETA,PSI,ALP,DLT,
     1                  GAM,ROPP,THOPP,THP,ETAP,TLE,PSIO,PSIOP)
C
C  TITLE
C     UNIFORM FLOW EFFECTS
C
C  PURPOSE
C     THIS SUBROUTINE COMPUTES UNIFORM FLOW EFFECTS BY THE FOLLOWING
C         COORDINATE TRANSFORM FOR SOURCE POSITION
C         COORDINATE TRANSFORM FOR OBSERVER DIRECTION ANGLES
C         SPECIAL LEADING EDGE TERM
C         WAVE NUMBER TRANSFORM
C         DIRECTIVITY ANGLE FOR REFERENCE PRESSURE OF DIFFRACTED
C              INCIDENT AND IMAGE FIELDS
C
C  INPUT - CALL SEQUENCE
C     AF        UNIT VECTOR IN DIRECTION OF AMBIENT FLOW
C     U,V,W     UNIT VECTORS FOR COORDINATE SYSTEM FIXED TO EDGE
C     AMACH     AIRCRAFT MACH NUMBER
C     ROP,THOP  POLAR COORDINATES OF APPARENT SOURCE WITH JET FLOW
C               REMOVED
C     TH,ETA    DIRECTION ANGLES RELATIVE TO EDGE
C     PSI       OBSERVER DIRECTIVITY ANGLE
C     ALP,DLT   ENGINE CENTERLINE ANGLES RELATIVE TO HALF PLANE
C
C  OUTPUT
C     GAM       TRANSFORMED WAVE NUMBER
C     ROPP      MAGNITUDE OF TRANSFORMED SOURCE POSITION
C     THOPP     PHASE OF TRANSFORMED SOURCE POSITION
C     THP,ETAP  TRANSFORMED OBSER POSITION ANGLES
C     TLE       LEADING EDGE TERM
C     PSIO      DIRECTIVITY ANGLES FOR DIFFRACTED INCIDENT FIELD
C     PSIOP     DIRECTIVITY ANGLES FOR DIFFRACTED IMAGE FIELD
C
C  NOTE
C     ALL INPUT AND OUTPUT ANGLES ARE IN DEGREES
C
      DIMENSION AF(3),U(3),V(3),W(3),R(3),EL(3)
C
      DATA DEGRAD,RADDEG,EPS /1.745329251943E-2,57.295779513082,1.2E-4/
C
C      INITIALIZATION COMPUTATIONS
C
      TLE   = 0.
      THOPP = THOP
      THP   = TH
      ETAP  = ETA
      ALP  =  ALP
      ROPP  =  ROP
      GAM  =  1.
      SINETA  =  SIN(ETA * DEGRAD)
      COSETA  =  SQRT(1. - SINETA*SINETA)
      IF  (ABS(AMACH) .LE. EPS)  GO TO 90
C     WAVE NUMBER TRANSFORM
C
      EMV=AMACH*DOTP(AF,V)
      GMA2=1./(1.-EMV*EMV)
```

```
      GAM=SQRT(GMA2)
      GAM1=GAM-1.
C
C     SOURCE COORDINATE TRANSFORM(ORIGINAL SOURCE VECTOR)
C
      CTHOP=COS(THOP*DEGRAD)
      STHOP=SIN(THOP*DEGRAD)
      R(1)= ROP*(STHOP*W(1)-CTHOP*V(1))
      R(2)= ROP*(STHOP*W(2)-CTHOP*V(2))
      R(3)= ROP*(STHOP*W(3)-CTHOP*V(3))
      DOT=DOTP(R,AF)
      EL(1)= R(1)-DOT*AF(1)
      EL(2)= R(2)-DOT*AF(2)
      EL(3)= R(3)-DOT*AF(3)
      ELMAG= SQRT(EL(1)*EL(1)+EL(2)*EL(2)+EL(3)*EL(3))
      IF(ELMAG.GT.0.)GO TO 20
      EL(1)= W(1)
      EL(2)= W(2)
      EL(3)= W(3)
      GO TO 40
   20 CALL VECN(EL)
   40 R(1) = R(1)+GAM1*DOT*AF(1)
      R(2)= R(2)+GAM1*DOT*AF(2)
      R(3)= R(3)+GAM1*DOT*AF(3)
      TMAG=SQRT(R(1)*R(1)+R(2)*R(2)+R(3)*R(3))
      COSXI = -DOT / ROP
      COSXIP=(COSXI+AMACH)/(1.+AMACH*COSXI)
      SINXIP=SQRT(1.-COSXIP*COSXIP)
C
C     NEW SOURCE VECTOR
C
      R(1) =TMAG*(SINXIP*EL(1)-COSXIP*AF(1))
      R(2) = TMAG*(SINXIP*EL(2)-COSXIP*AF(2))
      R(3) =TMAG*(SINXIP*EL(3)-COSXIP*AF(3))
      DOT= DOTP(R,U)
      R(1) = R(1)-DOT*U(1)
      R(2) = R(2)-DOT*U(2)
      R(3) = R(3)-DOT*U(3)
      ROPP=SQRT(R(1)*R(1)+R(2)*R(2)+R(3)*R(3))
      DOT=-DOTP(R,V)
      THOPP=ACOS(DOT/ROPP)*RADDEG
C
C     OBSERVER TRANSFORM (ORIGINAL OBSERVER VECTOR)
C
      COSTH  = COS(TH*DEGRAD)
      SINTH  = SIN(TH*DEGRAD)
      R(1)= SINETA*U(1)+COSETA*COSTH*V(1)-COSETA*SINTH*W(1)
      R(2)= SINETA*U(2)+COSETA*COSTH*V(2)-COSETA*SINTH*W(2)
      R(3)= SINETA*U(3)+COSETA*COSTH*V(3)-COSETA*SINTH*W(3)
      DOT=DOTP(R,AF)
      EL(1)= R(1)-DOT*AF(1)
      EL(2)= R(2)-DOT*AF(2)
      EL(3)= R(3)-DOT*AF(3)
      ELMAG=SQRT(EL(1)*EL(1)+EL(2)*EL(2)+EL(3)*EL(3))
      IF(ELMAG.GT.0.)GO TO 60
      EL(1)=-W(1)
      EL(2)=-W(2)
```

```
      EL(3)=-W(3)                                                       UNIFLW
      GO TO 80                                                          UNIFLW
   60 CALL VECN(EL)                                                     UNIFLW
   80 COSXI=DOT                                                         UNIFLW
      COSXIP=(COSXI-AMACH)/(1.-COSXI*AMACH)                             UNIFLW
      SINXIP=SQRT(1.-COSXIP*COSXIP)                                     UNIFLW
C                                                                       UNIFLW
C     NEW VECTOR TO OBSERVER                                            UNIFLW
C                                                                       UNIFLW
      R(1) =SINXIP*EL(1)+COSXIP*AF(1)                                   UNIFLW
      R(2) =SINXIP*EL(2)+COSXIP*AF(2)                                   UNIFLW
      R(3) =SINXIP*EL(3)+COSXIP*AF(3)                                   UNIFLW
      DOT= DOTP(R,U)                                                    UNIFLW
      ETAP=ASIN(DOT)*RADDEG                                             UNIFLW
      THP=0.0                                                           UNIFLW
      ARG1= -DOTP(R,W)                                                  UNIFLW
      ARG2=  DOTP(R,V)                                                  UNIFLW
      IF((ARG1.NE.0.).OR.(ARG2.NE.0.))THP=ATAN2(ARG1,ARG2)*RADDEG       UNIFLW
C                                                                       UNIFLW
C  CALC. SPECIAL LEADING EDGE TERM FACTOR AND REFERENCE DIRECTIVITY     UNIFLW
C  ANGLES GRAZING BARRIER EDGE FOR INCIDENT AND IMAGE SIGNALS           UNIFLW
C                                                                       UNIFLW
      IF(EMV.LT.0.)TLE=EMV/(1.+AMACH*COSXIP)                            UNIFLW
   90 SINALP  =   U(2)                                                  UNIFLW
      COSALP  =   SQRT(1. - SINALP*SINALP)                              UNIFLW
      ARG1   =   COSALP*COSETA*COS((THOP-DLT)*DEGRAD) - SINALP*SINETA   UNIFLW
      IF(ABS(ARG1).GT.1.)ARG1=SIGN(1.,ARG1)                             UNIFLW
      PSIO=180.-ACOS(ARG1)*RADDEG                                       UNIFLW
      IF  (TH .LE.-THOP)  GO TO 100                                     UNIFLW
      PSIOP=PSIO                                                        UNIFLW
      GO TO 200                                                         UNIFLW
  100 ARG1   =   COSALP*COSETA*COS((TH+DLT)*DEGRAD) - SINALP*SINETA     UNIFLW
      IF(ABS(ARG1).GT.1.)ARG1=SIGN(1.,ARG1)                             UNIFLW
      PSIOP=180.-ACOS(ARG1)*RADDEG                                      UNIFLW
  200 IF  (TH .LT. THOP)  PSIO = PSI                                    UNIFLW
C                                                                       UNIFLW
      RETURN                                                            UNIFLW
      END                                                               UNIFLW
```

```
      SUBROUTINE UNIT(DISTAT,NUMBER,SPL)
C AUTHOR             D. F. MELDRUM
C
C PURPOSE            TO CONVERT DATA AT ANY GIVEN REFERENCED DISTANCE
C                    TO AN INDEXED SPECTRA AT 3.281 FEET (1 METER)
C
C METHOD             ACCOUNT FOR SPHERICAL DIVERGENCE AND ATMOSHERIC
C                    ABSORPTIONS A STANDARD DAY CONDITIONS OF
C                    70 PERCENT RELATIVE HUMIDITY AND 59 DEGREES F.
C
C INPUTS             DISTAT    DISTANCE GIVEN FOR THE REFERENCED
C                              DATA (DISTANCD PREDICTED AT).
C                    NUMBER    NUMBER OF ANGLES OR SET OF SPECTRA
C                              TO BE CONVERTED.
C                    SPL       SPECTRA TO BE CONVERTED
C
C                    VIA LABLED COMMON GFREQ
C
C                    FREQ      1/3 OCTAVE CENTER BAND FREQUENCIES
C
C OUTPUTS            SPL       CONVERTED TO INDEXED SPECTRA
C
C FUNCTION SUBPRGM   ALOG10
C
C
      DIMENSION COEF(24),SPL(24,NUMBER)
C
C
      COMMON /GFREQ/ FREQ(24)
C
C
      DATA DISTGO/3.281/,ISWTCH/0/
C
      IF(ISWTCH.NE.0) GO TO 100
      ISWTCH=1
      CALL ABSORP(70.0,59.0,3,24,FREQ,COEF)
C
C
  100 SPHER=20.0*ALOG10(DISTAT/DISTGO)
C
      DO 200 I=1,24
      ATMOS=COEF(I)*(DISTAT-DISTGO)/1000.0
C
      DO 200 J=1,NUMBER
C
      IF(SPL(I,J).NE.0.0) SPL(I,J)=SPL(I,J)
     *                         +SPHER+ATMOS
  200 CONTINUE
      RETURN
      END
```

```
      SUBROUTINE VALUES(IMODE,NLS,NLF,XF,YF,Z,SCI,DE,EPR,DS,
     *        X1,X2,Y1,Y2,SUM,SLNL    ,IEC )
      COMMON/VALNL/NLST,NLFT
      COMMON/ASD/SD(3),NSL
      DIMENSION SUM(1),IEC(1),X1(1),X2(1),Y1(1),Y2(1)
      DIMENSION DS(1),SLNL(3)
      DIMENSION X1Q(5),X2Q(5),Y1Q(5),Y2Q(5),SUMQ(5),SLNLQ(3),IECQ(5)
      COMMON/FLIGHT/IMODEQ,XFQ,YFQ,ZQ,SCIQ,DEQ,EPRQ
      COMMON/RESULT/X1Q,X2Q,Y1Q,Y2Q,SUMQ,SLNLQ,IECQ
C
C
C       IF    IMODE= -1    INITIALIZATION OF CONTOUR PROGRAM
C             IMODE=  0    HOLD  NO ACTION    RETURN
C             IMODE=  1    REAL TIME OR 360/67 SIMULATION
      IF(IMODE) 1000,1030,1030
 1000 CONTINUE
      JJK=0
      DO 1001 I=1,3
      IF(DS(I).LT. 1.0)GO TO 1001
      SD(I)=DS(I)
      JJK=JJK+1
 1001 CONTINUE
      NSL=JJK
 1020 CONTINUE
      NLST=NLS
      NLFT=NLF
      CALL TEE227(IMODE,NLN)
      RETURN
 1030 CONTINUE
      IMODEQ=IMODE
      XFQ=XF
      YFQ=YF
      ZQ=Z
      SCIQ=SCI
      DEQ=DE
      EPRQ=EPR
      CALL VALUE2
      DO 1028 I=NLS,NLF
      X1(I)=X1Q(I)
      X2(I)=X2Q(I)
      Y1(I)=Y1Q(I)
      Y2(I)=Y2Q(I)
      SUM(I)=SUMQ(I)
      IEC(I)=IECQ(I)
 1028 CONTINUE
      DO 1029 I=1,NSL
 1029 SLNL(I)=SLNLQ(I)
      RETURN
      END
```

```
      SUBROUTINE VDIM(AARRAY,BARRAY,NEPR,NL,NLRO,NALFA,NLS,NLF)
C
C         THIS ROUTINE ASSUMES THAT THE AIRCRAFT IS FLYING IN THE (X,Y,Z
C         COORDINATE SYSTEM. THE POSITIONS (ONE TO THE RIGHT AND ONE TO
C         THE LEFT OF THE AIRCRAFT IN THE U,V SYSTEM) OF THE INTERSECTIO
C         OF THE CONTOUR ARE CALCULATED. THE COORDINATES OF THESE TWO PO
C         RELATIVE TO THE AIRCRAFT ARE TRANSFORMED INTO THE (X,Y,Z) SYST
C
C
C  REVISED BY D.G. DUNN  (17 JUN 1974)
C
C     IEC   ERROR CODE FOR EACH PARTICULAR CONTOUR
C            IEC LT 0    INDICATES NO ERROR
C            IEC EQ 0    INDICATES CONTOUR HAS CLOSED
C            IEC GT 0    INDICATES SINGULARITY CONDITION EXISTS
C
C     ASSUMPTIONS
C            -90 LT DE LT 90  I.E. COS(DE) GT ZERO
C              0  LT SCI LT 180 AND COS(DE) DOES NOT EQUAL SCI
C     RPD  ... RADIANS PER DEGREE (1.745329252E-2)
C     DPR  ... DEGREES PER RADIAN (57.2957795     )
      DIMENSION SUM(5),IEC(5),U(5),V(5),X1(5),X2(5),Y1(5),Y2(5)
      DIMENSION U2(5), V2(5), SAX(5)
      COMMON/ASD/SD(3),NSL
      COMMON/CONTNT/AEPR(6),ALRO(9),AALFA(6)
      COMMON/FLIGHT/IMODE,XF,YF,Z,SCI,DE,EPR
      COMMON/RESULT/X1,X2,Y1,Y2,SUM,SLNL,IEC
      DIMENSION AARRAY(NLRO,NALFA,NEPR),BARRAY(NEPR,NALFA,NL)
      DIMENSION SLNL(3),SUMX(5)
      DOUBLE PRECISION SUMX
C
C            DATA CONSTANTS
      DATA I0, I1, I2 /0,1,2/
      DATA INDX, MAXIT, EPS2, U, V, SAX /1,10,1.2E-5,10*0.,5*45.0/
      DATA DPR,RPD,ONE,ZERO,P5,EPS,H1,H2,H3/57.2957795,0.01745329252,
     11.0,0.0,0.5,1.E-4,90.0,180.0,360.0/
      GO TO 1360
      ENTRY RESTRT
 1010 INDX  =  I1
      DO  1020  I=1,NL
      SUM(I)  =  ZERO
      SUMX(I)  =  ZERO
      IEC(I)  = -I1
 1020 CONTINUE
      GO TO 1360
      ENTRY VALUE2
 1030 CONTINUE
      DO  1040  I=NLS,NLF
 1040 IEC(I)  = -I1
      IF  (INDX .GT. I1)  GO TO 1060
      DO  1050   I=NLS,NLF
      SUM(I)  =  ZERO
      SUMX(I)  =  ZERO
      U2(I)  =  ZERO
      V2(I)  =  ZERO
 1050 CONTINUE
      XS=XF
```

```
      YS=YF
      ZO=Z
      ST  =  ZERO
      CT  =  ONE
C     REDUCE ANGLES (DE,SCI) TO APPROPRIATE QUADRANTS
 1060 SCI=AMOD(SCI,H3)
C
      SCI=ABS(SCI-H3*FLOAT(IFIX(SCI/H2)))
      DE=AMOD(DE,H3)
      DE=DE-H3*FLOAT(IFIX(DE/H2))
      IF (ABS(DE)-H1)  1080,1080,1070
C     RESTRICTION OF RANGE TEST ON DE
 1070 DE=DE-SIGN(H2,DE)
      SCI=H2-SCI
C
 1080 A1=SCI*RPD
      A2=DE*RPD
      A3 =A1-A2
C     A3 REPRESENTS
      A3T=ABS(ABS(A3)-1.570796)-EPS
C     1.5707963267949  A REPRESENTATION OF PI/2
      IF (A3T)  1100,1100,1090
C     RESTRICTION OF RANGE
 1090 TA3=TAN(A3)
C           TANGENT OF SCI-DE
 1100 SA2=SIN(A2)
C           SINE OF DE
      SA2S=SA2*SA2
C           SINE SQUARED DE
      CA2S=ONE-SA2S
C           COSINE SQUARED DE
      CA2=SQRT(CA2S)
      CA1=COS(A1)
      CA1S=CA1*CA1
C
C
      ZS=Z*Z
      DX  =  XF - XS
      DY  =  YF - YS
      DZ  =  Z - ZO
      DL  =  DX*DX + DY*DY
      DV  =  DL + DZ*DZ
      IF  (DV .LE. ZERO)  GO TO 1101
      CA4  =  SQRT(DL / DV)
      GO TO 1102
 1101 CA4  =  ONE
 1102 ZE  =  Z * CA4
      ZES=ZE*ZE
C
C    OBTAIN THE NOISE LEVEL AT DISTANCE SD AND AT ALTITUDE Z
      DO 1120 I=1,NSL
      ALPHA1=ATAN(ZE/SD(I))*DPR
      SLLRO  =  P5 * ALOG10(ZES + SD(I)*SD(I))
      SLNL(I)  =  TBLU3(SLLRO, ALPHA1, EPR, ALRO, AALFA, AEPR, AARRAY,
     * I1, I1, I1, NLRO, NALFA, NEPR, NLRO, NALFA, NEPR)
 1120 CONTINUE
C
```

```
C                                                                       VDIM
C                                                                       VDIM
C     OBTAIN QUADRATIC EQUATION COEFICIENTS (A,B) WHICH DO              VDIM
C     NOT VARY FOR EACH NOISE CONTOUR(J)                                VDIM
      A=CA2S-CA1S                                                       VDIM
      B=2.*(Z*SA2*CA2)                                                  VDIM
      CC=ZS*(SA2S-CA1S)                                                 VDIM
      IF (A)  1140,1130,1140                                            VDIM
 1130 IF (B)  1150,1160,1150                                            VDIM
 1140 P1=B/(A+A)                                                        VDIM
      P1S=P1*P1                                                         VDIM
      IP  = -I1                                                         VDIM
      GO TO 1170                                                        VDIM
 1150 IP  =  I0                                                         VDIM
      GO TO 1170                                                        VDIM
 1160 IP  =  I1                                                         VDIM
C                                                                       VDIM
C     OBTAIN SINE AND COSINE OF FLIGHT VECTOR FOR TRANSFORMATION        VDIM
C     OF COORDINATE (U,V) TO (X,Y,Z)                                    VDIM
 1170 DS  =  SQRT(DU)                                                   VDIM
      IF (DS)  1190,1190,1180                                           VDIM
 1180 ST=-(DX/DS)                                                       VDIM
      CT=DY/DS                                                          VDIM
C                                                                       VDIM
C     ITERATION FOR EACH CONTOUR(J)                                     VDIM
C                                                                       VDIM
 1190 DO  1340  J = NLS,NLF                                             VDIM
C                                                                       VDIM
C  ITERATION INVOLVING THE ELEVATION ANGLE (SA  =  ALPHA) WHICH IS A    VDIM
C  FUNCTION OF THE AIRPLANE ALTITUDE AND RANGE FOR A SPECIFIED NOISE    VDIM
C  CONTOUR.                                                             VDIM
C  CODE USES WEGSTEINS SECANT ITERATION SCHEME EXTRACTED FROM SUBR. RTWI VDIM
C  REF... IBM SYS/360 SCIENTIFIC SUBROUTINE PACKAGE, VER.III,           VDIM
C             H20-0166-5, 1968, PP. 215-216                             VDIM
      DX  =  SAX(J)                                                     VDIM
      I  = -I1                                                          VDIM
      K  =  I2                                                          VDIM
C                                                                       VDIM
C  FIRST FUNCTION EVALUATION                                            VDIM
   10 RO  =  10.**TBLU2(EPR, DX, AEPR, AALFA, BARRAY(1,1,J),I1,I1, NEPR, VDIM
     * NALFA, NEPR, NALFA)                                              VDIM
      IF  (RO - ZE)  20, 20, 30                                         VDIM
   20 SA  =  (DX + H1) * P5                                             VDIM
      GO TO 40                                                          VDIM
   30 SA  =  DPR * ASIN(ZE / RO)                                        VDIM
   40 IF  (I)  50, 60, 120                                              VDIM
   50 DU  =  SA - DX                                                    VDIM
      IF  (ABS(DU) - EPS2 * ABS(SA))  140, 140, 55                      VDIM
   55 DV  =  -DU                                                        VDIM
      DX  =  SA                                                         VDIM
      I  =  I0                                                          VDIM
C                                                                       VDIM
C  SECOND FUNCTION EVALUATION                                           VDIM
      GO TO 10                                                          VDIM
   60 DY  =  DX - SA                                                    VDIM
      I  =  I1                                                          VDIM
      IF  (ABS(DY) -  PS2 * ABS(SA))  140, 140, 80                      VDIM
```

```
   80 K  =  K + I1
      IF  (K - MAXIT)  90, 90, 140
   90 IF  (DY)  100, 140, 100
  100 DV  =  DV / DY - ONE
      IF  (DV)  110, 140, 110
  110 DU  =  DU / DV
      DX  =  DX + DU
      DV  =  DY
C
C  THIRD TO MAXIT FUNCTION EVALUATIONS
      GO TO 10
  120 DY  =  DX - SA
      DA  =  EPS2 * ABS(DX)
      IF  (ABS(DU) - DA)  130, 130, 80
  130 IF  (ABS(DY) - 10.*DA)  140, 140, 80
  140 SAX(J)  =  SA
 1220 ROS  =  RO * RO
      US  =  ROS - ZES
C     TEST  FOR PROPER RANGE OF U SQUARED. (IF CONTOUR HAS CLOSED)
      IF  (US)  1230, 1230, 1260
 1230 U(J)=ZERO
      V(J)=ZERO
      IEC(J)  =  I0
      IF  (ABS(CA4*DZ) .LE. EPS*RO)  GO TO 1320
      DV  =  -DS * (Z - (RO/CA4)) / DZ
      IF  (ABS(DV) .LT. DS)  V(J) = DV
      IF(A3T) 1320,1320,1240
C     TEST TO SEE IF RADIATION DIRECTION IS STRAIGHT DOWN
 1240 V(J)  =  V(J) + RO / (CA4 * TA3)
      GO TO  1320
 1260 U(J)=SQRT(US)
      C=-US*CA  CC
      IF  (IP)  1270, 1300, 1310
 1270 P2S=P1S-C/A
      IF (P2S)  1280,1290,1290
C     TEST FOR NOISE CONE FORMING AN ELLIPSE NOT
C     INTERSECTING THE SIDELINE
 1280 P2S=-P2S
      IF(P2S-EPS*P1S)1290,1290,1285
 1285 IEC(J)  =  I1
      GO TO  1330
 1290 P2=SIGN(SQRT(P2S),CA1)
      V(J)=P1+P2
      GO TO  1320
 1300 V(J)=C/B
      GO TO  1320
 1310 V(J)=ZERO
 1320 UST=U(J)*ST
      UCT=U(J)*CT
      DU=XF-V(J)*ST
      DV=YF+V(J)*CT
C
C     TRANSFORMATION OF COORDINATES(U,V) TO (X,Y)
      X1(J)=DU+UCT
      X2(J)=DU-UCT
      Y1(J)=DV+UST
      Y2(J)=DV-UST
```

```
      DA  =  (U(J) + U2(J)) * (V(J) - V2(J) + CS)                   VDIM      230
      SUMX(J)=SUMX(J)+DA                                             VDIM      231
      IF  (INDX .LE. I1)  SUMX(J) = ZERO                             VDIM      232
      SUM(J)=SUMX(J)                                                 VDIM      233
 1330 U2(J)  =  U(J)                                                 VDIM      234
      V2(J)  =  V(J)                                                 VDIM      235
 1340 CONTINUE                                                       VDIM      236
      INDX  =  INDX + I1                                             VDIM      237
      XS=XF                                                          VDIM      238
      YS=YF                                                          VDIM      239
      ZO=Z                                                           VDIM      240
 1360 RETURN                                                         VDIM      241
      END                                                            VDIM      242
```

```
      SUBROUTINE VECN(A)                                                VECTOR
C                                                                       VECTOR
C  ROUTINE TO NORMALIZE A VECTOR                                        VECTOR
C                                                                       VECTOR
      DIMENSION A(3)                                                    VECTOR
      AX = SQRT(A(1)*A(1) + A(2)*A(2) + A(3)*A(3))                      VECTOR
      IF(AX.EQ.0.)RETURN                                                VECTOR
      A(1) = A(1)/AX                                                    VECTOR
      A(2) = A(2)/AX                                                    VECTOR
      A(3) = A(3)/AX                                                    VECTOR
      RETURN                                                            VECTOR
      END                                                               VECTOR
```

```
      FUNCTION  DOTP(A,B)
C
C  COMPUTES DOT PRODUCT OF TWO VECTORS, (A.B)
C
      DIMENSION A(3), B(3)
      DOTP = A(1)*B(1) + A(2)*B(2) + A(3)*B(3)
      RETURN
      END
```

```
      SUBROUTINE  CROSP(A,B,C)
C
C  ROUTINE TO COMPUTE THE CROSS PRODUCT, A=B * C
C
      DIMENSION A(3), B(3), C(3)
      A(1) = B(2)*C(3) - C(2)*B(3)
      A(2) =C(1)*B(3) - B(1)*C(3)
      A(3) = B(1)*C(2) - C(1)*B(2)
      RETURN
      END
```

```
      SUBROUTINE WRPNL(NK,I,L,LCT,IPT)
      COMMON /GCONST/ IN,IO,IT1,IT2,F0,F1,F2,F3,F4,F5,F6,F7,F8,F9,F10,
     *                 I0,I1,I2,I3,I4,I5,I6,I7,I8,I9,I10,P1,P33,P5,P001,
     *                 EPS,UNDEF,BL,ICO,DPR,RPD,ETA(17),M1,FM1,I17,A,PI
C     AIRCRAFT-OBSERVER GEOMETRY OUTPUTS
C
      COMMON/SWITCH/NTYPE,ITYPE,NENG,ICCP,IPRT(7),ICN(13),NLOPT
      COMMON /GEOMO/ APY(10,17),APZ(10,17),PD(10,17),DPND(10,17),
     * B1(10,17),B2(10,17),TDS(17,10),TPD(17,10),IRR(10,17)
     *,APP,TP,RHP,APO,TO,RHO,CA,CZ,TSP(17,10),CGV
C
      COMMON/CLABEL/CH(2,8)
      COMMON /GPRAM/ALTP,ALTR,SLOPE,AMACH,NOBS,SLDIST(10),NTENG,IUNIT
     *     ,ISPTRM,IATMOS,IAIR,LAIRAB(24),NTEMP,TEMP(50),TALT(50)
     *     ,NPRES,PRES(50),PALT(50),NHUMID,RALT(50),RHUMID(50),CTEMP
     *     ,CPRES,CRHUMD,IEGA,IGDR,DTEMP,DPRES,DHUMID,XKN,NC,FLD(50),
     * ZNR(50),ZNI(50),LINECT,MAXLIN,IPAGE,BCG,TCG,FLR,AALT,EPF
      COMMON/PNLD/PSPL(17,20),EPNL(5,10),TEPNL(5,10)
      COMMON/GCONVC/C(2,10),SLDISX(10)
      COMMON/CRSPLS/DOB(17),PSCR(17),DFB(408),NPSCR
      DIMENSION PNL(3),TCPNL(3),T(3)
      DATA PNL/4H PNL,4H  (P,4HNDB)/,TCPNL/4H TCP,4HNL(P,4HNDB)/,
     *       T/4H T   ,4H  (S,4HEC) /
      WRITE(L,100)
      LCT=LCT+1
 100  FORMAT(1H )
      WRITE(L,90)(ETA(J),J=1,17)
 90   FORMAT(2X,10HXI    (DEG),17F7.1)
      DO 95 J=1,17
      IF(PSPL(J,I).EQ.0.)PSPL(J,I+10)=0.
 95   CONTINUE
      WRITE(L,110)PNL,(PSPL(J,I),J=1,17)
      LCT=LCT+2
      IF(NK.NE.3) GO TO 105
      WRITE(L,110)TCPNL,(PSPL(J,I+10),J=1,17)
     -LCT=LCT+1
  105 WRITE(L,110)T,(TPD(J,I),J=1,17)
      LCT=LCT+1
      WRITE(L,100)
      LCT=LCT+1
 110  FORMAT(1H ,3A4,F6.1,16F7.1)
      WRITE(L,120)(EPNL(J,I),J=1,5)
      LCT=LCT+1
 120  FORMAT(20H  EPNL*(EPNDB) =      ,F6.1,1X,28HBASED ON MIN/MAX PNL
     *=    ,F6.1,1H,,F6.1,24H PNDB AND TIME LIMITS  =,5X,F6.1,1H,,F6.1,
     *1X,3HSEC)
      IF(IPT.EQ.1)GO TO 121
      IF(IPRT(1).NE.8)GO TO 128
 121  CONTINUE
      IF(NLOPT .EQ. 0)GO TO 128
      IF  (NLOPT-1)  122, 122, 124
  122 XNL=EPNL(1,I)
      GO TO 125
  124 XNL=EPNL(3,I)
  125 ELANG=B2(I,9)
      CPAR9=PD(I,9)
      IF (IUNIT .EQ. 0)CPAR9=PD(I,9)*0.3048
```

```
      CPAR9=ALOG10(CPAR9)
      WRITE(20,170)XNL,EPF,ELANG,CPAR9
  170 FORMAT(1PE12.3,3E12.3)
  128 CONTINUE
      IF(NK.NE.3)GO TO 140
      WRITE(L,130)(TEPNL(J,I),J=1,5)
      LCT=LCT+1
 130  FORMAT(20H  EPNL (EPNDB) =     ,F6.1,1X,
     *  28HBASED ON MIN/MAX TCPNL  =       ,F6.1,1H,
     *,F6.1,1X,23HPNDB AND TIME LIMITS  =,5X,F6.1,1H,,F6.1,1X,3HSEC  )
 140  WRITE(L,100)
      LCT=LCT+1
      PX=PD(I,9)
      BX=B2(I,9)
      IF(IUNIT .NE. 0)GO TO 145
      IF(IPT.EQ.1)GO TO 145
      IF(IPT.EQ.8)GO TO 145
      PX=PX*C(2,1)
  145 CONTINUE
      WRITE(L,150)EPF,PX,CH(IUNIT+1,1),BX
      LCT=LCT+1
 150  FORMAT(20H  ENG.PERF.PARM.=    ,1PE10.3,18H, RANGE AT CPA  = ,
     * E10.3,A3,15H, ELEV.ANGLE = ,E10.3,5H DEG./ )
      RETURN
      END
```

```
      SUBROUTINE WSHOUT(IPRNT,IOUT,ITYPE,USPL,NUSPL,PSI,INUSP)
C
C  PURPOSE
C     PRINTOUT THE WING SHIELDING VARIABLES
C
C  INPUT - CALLING SEQUENCE
C     IPRNT  - REPORT INDICATOR FOR SUBROUTINE PRINTH
C     IOUT   - OUTPUT UNIT
C     ITYPE  - COMPONENT NOISE TYPE
C     USPL   - ARRAY OF INPUT OR BUILT IN UNSHIELDED SPL TO BE USED
C     NUSPL  - NUMBER OF USPL
C     PSI    - DIRECTIVITY ANGLES AT WHICH PSI ARE INPUT
C     INUSP  - NON-ZERO WHEN USPL ARE TO BE PRINTED, I.E. NOT PREDICTED
C
C  INPUT - COMMON
C     REFRAC - ALL VARIABLES ARE PRINTED
C
C
      DIMENSION USPL(1),PSI(1),CCMTI(8,4)
      COMMON/TURBIN/ROT(9),ISW3
C
      COMMON/REFRAC/EMJ,TSTSC,IWED(3),FASS(24),BETA(24),CPSIC(24),NASRO,
     * ASF,IWSFE
C
      DATA COMTI/4HCORE,4H NOI,4HSE  ,5*1H ,
     *            4HTURB,4HINE ,4HNOIS,4HE   ,4*1H ,
     *            4HCOMP,4HRESS,4HOR A,4HND I,4HNLET,4H FAN,4H NOI,4HSE
     2          ,4HEXIT,4H FAN,4H NOI,4HSE  ,4H    ,4H    ,4H    ,4H    /
C
C     PRINT STANDARD TITLE
C
      CALL PRINTH(IPRNT,LCT,IOUT)
C
C     PRINT COMPONENT NOISE TYPE TITLE
C
      IF(ITYPE.NE.3)ITIT=ITYPE-1
      IF(ITYPE.EQ.3)ITIT=ISW3-1
      WRITE(IOUT,100) (CCMTI(I,ITIT),I=1,8)
  100 FORMAT(1H0,43X,8A4)
C
C     PRINT INPUT TYPE
C
      WRITE(IOUT,200)
  200 FORMAT(1H0,38X,39HW I N G   S H I E L D I N G   I N P U T S)
C
C     PRINT INPUT FOR FAN, TURBINE AND CORE NOISE CASES
C
      WRITE(IOUT,300) (IWED(I),I=1,3)
  300 FORMAT(////17X,46H1) EDGE SOLUTIONS CONSIDERED (1 = YES, 0 = NO)/
     1 22X,13HTRAILING E. =,I3,1H,,10X,12HLEADING E. =,I3,1H,,
     2 15X,8HTIP E. =,I3)
      IF( INUSP.EQ.0 ) GO TO 600
      WRITE(IOUT,400) ( USPL(I),I=1,NUSPL)
  400 FORMAT(1H0,16X,31H2) UNSHIELDED DIRECTIVITY CURVE/1H0,19X,
     1 11HSPL (DB)  =,10F7.1/(31X,10F7.1))
      WRITE(IOUT,500) ( PSI(I),I=1,NUSPL)
  500 FORMAT(1H0,19X,11HPSI (DEG) =,10F7.1/(31X,10F7.1))
```

```
C
C     PRINT FOR DISCHARGE FAN, CORE AND TURBINE CASES BUT NOT INLET FAN
C
  600 IF( ITYPE.EQ.4 ) GO TO 1000
      WRITE (IOUT,700) EMJ, TSTSO, (FASS(I), I = 1,NASRC)
  700 FORMAT(///17X,27H3) EXHAUST FLOW MACH NO. = ,F7.3,1H,,
     1 27HSTATIC TEMPERATURE RATIO = ,F7.3//
     2 17X,48H4) CORRECTION FACTOR FOR ANGULAR SHIFT OF SOURCE /
     3 1H0,19X,11HALFA      =,8F8.3/(31X,8F8.3))
      WRITE (IOUT,900) (CPSIO(I), I = 1,NASRC)
      WRITE (IOUT,750) ASF
  750 FORMAT(1H0,16X,36H5) ANGLE OFFSET FOR ANGULAR SHIFT OF,
     1 16H SOURCE, GAMA = ,F8.3)
      WRITE(IOUT,800) (BETA(I),I=1,NASRC)
  800 FORMAT(1H0,16X,35H6) RADIAL OFFSET OF APPARENT SOURCE /
     1 1H0,19X,11HBETA      =,8F8.3/(31X,8F8.3))
      WRITE(IOUT,900) (CPSIO(I),I=1,NASRC)
  900 FORMAT(1H0,19X,11HCOT(PSIO) =,8F8.3/(31X,8F8.3))
C
 1000 RETURN
      END
```

```
      SUBROUTINE WSDSTO(ITYPE,INASRO,IS1,IS2,ST6,                       WSDSTO
     *                  ST1,ST2,ST3,ST4,ST5,ISOR)                       WSDSTO
C     PURPOSE       TO STORE WING SHIELDING DATA FOR COMPONENT          WSDSTO
      DIMENSION IS1(3),IS2(3),ST1(3),ST2(1),ST3(1),ST4(1),ST5(1),ST6(1) WSDSTO
      COMMON/REFRAC/EMJ,TSTSO,IWED(3),FASS(24),BETA(24),CPSIO(24),NASRO, WSDSTO
     * ASF,IWSFE                                                        WSDSTO
      COMMON/UNSHLD/USPL(19),PSI(19),NUSPL,INUSP                        WSDSTO
      IF(ISOR.GT.1)GO TO 100                                            WSDSTO
C     STORE                                                             WSDSTO
      IS1(1)=NUSPL                                                      WSDSTO
      IS1(2)=INUSP                                                      WSDSTO
      DO 20 I=1,3                                                       WSDSTO
   20 IS2(I)=IWED(I)                                                    WSDSTO
C                                                                       WSDSTO
C     TEST WHETHER DIRECTIVITY CURVES TO BE READ IN.                    WSDSTO
C     IF NOT ASSUME DEFAULT OR PREDICTED VALUES                         WSDSTO
C                                                                       WSDSTO
      IF(INUSP.LT.2)GO TO 40                                            WSDSTO
C                                                                       WSDSTO
C     STORE DIRECTIVITY CURVES INPUT AS DATA                            WSDSTO
C                                                                       WSDSTO
      CALL SN(USPL,ST2,1,NUSPL,2)                                       WSDSTO
      CALL SN(PSI,ST3,1,NUSPL,2)                                        WSDSTO
C                                                                       WSDSTO
C     IF INLET FAN EXIT                                                 WSDSTO
C                                                                       WSDSTO
   40 IF(ITYPE.EQ.4)GO TO 80                                            WSDSTO
C                                                                       WSDSTO
C     STORE SHIELDING DATA FOR AFT FAN,TURBINE AND CORE                 WSDSTO
C                                                                       WSDSTO
      ST1(1)=EMJ                                                        WSDSTO
      ST1(2)=TSTSO                                                      WSDSTO
      ST1(3)   =   ASF                                                  WSDSTO
      IS1(3)=INASRO                                                     WSDSTO
      IF(INASRO.EQ.0)GO TO 80                                           WSDSTO
C                                                                       WSDSTO
C  STORE EMPIRICAL CURVES FOR JET REFRACTION MODEL                      WSDSTO
C                                                                       WSDSTO
      CALL SN(BETA,ST4,1,INASRO,2)                                      WSDSTO
      CALL SN(CPSIO,ST5,1,INASRO,2)                                     WSDSTO
      CALL SN(FASS,ST6,1,INASRO,2)                                      WSDSTO
   80 RETURN                                                            WSDSTO
C                                                                       WSDSTO
C     RESTORE WING SHIELDING DATA                                       WSDSTO
C                                                                       WSDSTO
  100 NUSPL=IS1(1)                                                      WSDSTO
      INUSP=IS1(2)                                                      WSDSTO
      DO 120 I=1,3                                                      WSDSTO
  120 IWED(I)=IS2(I)                                                    WSDSTO
C                                                                       WSDSTO
C     TEST IF DIRECTIVITY CURVE INPUT AS DATA                           WSDSTO
C     IF NOT ASSUME DEFAULT OR PREDICTED VALUES                         WSDSTO
C                                                                       WSDSTO
      IF(INUSP.LT.2)GO TO 140                                           WSDSTO
C                                                                       WSDSTO
C     RESTORE DIRECTIVITY CURVES                                        WSDSTO
C                                                                       WSDSTO
```

```
      CALL SN(USPL,ST2,1,NUSPL,1)                                    WSDSTO
      CALL SN(PSI,ST3,1,NUSPL,1)                                     WSDSTO
C                                                                    WSDSTO
C     EXIT IF INLET FAN                                              WSDSTO
C                                                                    WSDSTO
  140 IF  (ITYPE .EQ. 4)  GO TO 80                                   WSDSTO
C                                                                    WSDSTO
C     RESTORE SHIELDING DATA FOR AFT FAN,TURBINE AND CORE            WSDSTO
C                                                                    WSDSTO
      EMJ=ST1(1)                                                     WSDSTO
      TSTSO=ST1(2)                                                   WSDSTO
      ASF  =  ST1(3)                                                 WSDSTO
      INASRO=IS1(3)                                                  WSDSTO
      IF(INASRO.EQ.0)GO TO 80                                        WSDSTO
C                                                                    WSDSTO
C  RESTORE EMPIRICAL CURVES FOR JET REFRACTION MODEL                 WSDSTO
C                                                                    WSDSTO
      CALL SN(BETA,ST4,1,INASRO,1)                                   WSDSTO
      CALL SN(CPSIO,ST5,1,INASRO,1)                                  WSDSTO
      CALL SN(FASS,ST6,1,INASRO,1)                                   WSDSTO
      GO TO 80                                                       WSDSTO
      END                                                            WSDSTO
```

```
      FUNCTION XINTEG(X,Y,NPTS)
C PURPOSE              TO INTEGRATE A TABULATED FUNCTION OF ONE INDEPENDENT
C                      VARIABLE BY TRAPEZOIDAL RULE
C AUTHOR               R. M. MASTERS
C MODIFICATIONS        NONE
C
C METHOD               THIS SUBROUTINE USES THE TRAPEZOIDAL RULE TO
C                      INTEGRATE A TABULATED FUNCTION WHICH HAS EQUAL OR
C                      UNEQUAL STEP SIZES.
C
C USAGE                A = XINTEG(X,Y,NPTS)
C                      DIMENSION X(1),Y(1)
C
C  INPUTS              X - ARRAY OF NPTS INDEPENDENT VARIABLE VALUES FOR
C                          UNEQUAL SPACING OR DELTA X VALUE FOR EQUAL
C                          SPACING
C                      Y - ARRAY OF NPTS TABULATED FUNCTION VALUES
C                      NPTS - NUMBER OF POINTS TO BE INTEGRATED (POSITIVE
C                             FOR UNEQUAL SPACING, NEGATIVE FOR EQUAL
C                             SPACING)
C
C OUTPUTS              A - THE INTEGRAL OF THE TABULATED FUNCTION
C
C ERROR RETURN         NONE
C STORAGE              112 BASE EIGHT
C TIMING               NO TIMING RUNS WERE MADE
C REFERENCES           NONE
C SUBROUTINES CALLED
C                      NONE
C
C DOCUMENTATION        AMEP-S-162
C               NPTS .GE. 2  = POINTS UNEQUALLY SPACED,
C               NPTS .LE.-2  = POINTS EQUALLY SPACED,
C               OTHERWISE THE INTEGRAL IS SET TO ZERO.
C                     1)    FOR UNEQUAL SPACING THE X ARRAY CONTAINS THE
C                           INDEPENDENT VARIABLE VALUES CORRESPONDING TO
C                           THE Y ARRAY (DEPENDENT VALUES).
C                     2)    FOR EQUAL SPACING X(1) CONTAINS THE INCREMENT
C                           BETWEEN INDEPENDENT VARIABLE VALUES.
C                     3)    NPTS IS THE NUMBER OF DEPENDENT VARIABLE POINTS
C                           TO BE INTEGRATED (+ FOR UNEQUAL SPACING, - FOR
C                           EQUAL SPACING).
C                     4)    ANYTIME THERE ARE LESS THAN 2 DATA POINTS
C                           THE INTEGRAL IS SET TO ZERO.
      DIMENSION X(2), Y(2)
      IF(NPTS.LE.-2) GO TO 200
      IF(NPTS.LE.2) GO TO 400
C        *****UNEQUAL SPACING*****
      NPTS1=NPTS-1
      SUM=Y(1)*(X(2)-X(1))+Y(NPTS)*(X(NPTS)-X(NPTS1))
      IF(NPTS.EQ.2) GO TO 150
      DO 100 I=2,NPTS1
      SUM=SUM+Y(I)*(X(I+1)-X(I-1))
  100 CONTINUE
  150 XINTEG=.5*SUM
      RETURN
  200 CONTINUE
```

```
C          *****EQUAL SPACING*****
      NPTSA=IABS(NPTS)
      NPTS1=NPTSA-1
      SUM=.5*(Y(1)+Y(NPTSA))
      IF(NPTSA.EQ.2) GO TO 350
      DO 300 I=2,NPTS1
      SUM=SUM+Y(I)
  300 CONTINUE
  350 XINTEG=X(1)*SUM
      RETURN
  400 CONTINUE
C          *****LESS THAN 2 DATA POINTS*****
      XINTEG=0.
      RETURN
      END
```

```
      FUNCTION XPM1DX(Y)
C  FUNCTION XPM1DX(Y) SUB-SECTION FOR COMPUTING (EXP(Y) - 1) / Y  TO
C  MAXIMUM MACHINE ACCURACY AND TO AVOID OVERFLOWS.
      DOUBLE PRECISION S, P
      EQUIVALENCE (S,SK), (P,PK)
      DATA YL, ONE, EP /.3465736, 1.0, 1.2E-7/
   12 IF  (ABS(Y) - YL)  14, 13, 13
   13 XPM1DX  =  (EXP(Y) - ONE) / Y
      GO TO 18
   14 S  =  ONE
      P  =  ONE
      F  =  ONE
   15 F  =  F + ONE
      P  =  P * Y / F
   16 S  =  S + P
      IF  (ABS(PK) - EP * ABS(SK))  17, 17, 15
   17 XPM1DX  =  S
   18 RETURN
      END
```

```
      SUBROUTINE ZERO(DATA,NUMBER)
C AUTHOR            D. F. MELDRUM
C
C PURPOSE           TO ZERO OUT AN ARRAY
C
C INPUTS            DATA       ARRAY TO BE ZEROED OUT
C                   NUMBER     NUMBER OF ELEMENTS TO BE ZEROED OUT
C
C OUTPUTS           DATA       ARRAY WHICH IS ZEROED OUT FOR
C                              (NUMBER) OF ELEMENTS.
C
C
      DIMENSION DATA(NUMBER)
      DO 100 I=1,NUMBER
  100 DATA(I)=0.
C
      RETURN
      END
```


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